

# Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Sat 30 Mar 2024 14:09:01

Project Information			
Assessed By	Mark Scotson	Building Type	Flat, Detached
OCDEA Registration	EES/027465	Assessment Date	2024-03-30

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m <sup>2</sup>
Site Reference	Ground Flat, 3 Avenue Road	Plot Reference	ASHP & Solar
Address	Ground Flat, 3 Avenue Road, TR114A2		

Client Details	
Name	Client
Company	-
Address	-, -, -

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	13.85 kgCO <sub>2</sub> /m <sup>2</sup>		
Dwelling carbon dioxide emission rate	3.19 kgCO <sub>2</sub> /m <sup>2</sup>	OK	
1b Target primary energy rate and dwelling primary energy			
Target primary energy	72.74 kWh <sub>PE</sub> /m <sup>2</sup>		
Dwelling primary energy	53.02 kWh <sub>PE</sub> /m <sup>2</sup>	OK	
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	36.8 kWh/m <sup>2</sup>		
Dwelling fabric energy efficiency	30.6 kWh/m <sup>2</sup>	OK	

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.15	Ground Floor (0.15)	OK
Roofs	0.16	0.15	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.2	W (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]
Exposed wall: Walls (1)	46.85	0.18
Ground floor: Ground Floor , Ground Floor	50.13	0.15
Exposed roof: Roof (1)	4.46	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
W, Window	5.78	South	0.7	1.2
W, Window	5.67	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.088	
External wall	E3: Sill	Calculated by person with suitable expertise	0.047	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.033 (!)	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.049	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.035 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	0.035 (!)	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.031 (!)	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m <sup>3</sup> /hm <sup>2</sup>		
Dwelling air permeability at 50Pa		3 m <sup>3</sup> /hm <sup>2</sup> , Design value (!)		OK
Air permeability test certificate reference		5151151		

4 Space heating	
<b>Main heating system 1:</b> Heat pump with radiators or underfloor heating - Electricity	
Efficiency	115.3%
Emitter type	Underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	ECODAN
Commissioning	
<b>Secondary heating system:</b> N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
<b>Cylinder/store</b> - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.45 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
<b>Waste water heat recovery system 1</b> - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
<b>Main heating 1</b> - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
<b>Water heating</b> - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
<b>System type:</b> Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.65 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	89%	OK
Manufacturer/Model	MRXBOXAB-ECO2, MRXBOXAB-ECO2C	
Commissioning		
9 Local generation		
Technology type: <b>Photovoltaic system (1)</b>		
Peak power	3 kWp	
Orientation	West	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

# Full SAP Calculation Printout



Property Reference	Ground Flat, 3 Avenue Road		Issued on Date	30/03/2024	
Assessment Reference	ASHP & Solar	Prop Type Ref	1		
Property	Ground Flat, 3 Avenue Road , , TR114A2				
SAP Rating	84 B	DER	3.19	TER	13.85
Environmental	98 A	% DER < TER			76.97
CO <sub>2</sub> Emissions (t/year)	0.06	DFEE	30.56	TFEE	36.84
Compliance Check	See BREL	% DFEE < TFEE			17.06
% DPER < TPER	27.11	DPER	53.02	TPER	72.74
Assessor Details	Mr. Mark Scotson			Assessor ID	AX66-0001
Client	Client , Client				

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	50.1300 (1b)	2.3000 (2b)	115.2990 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300		115.2990 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 115.2990 (5)

## 2. Ventilation rate

	m <sup>3</sup> per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (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) =												80.1000 (23c)
Effective ac	0.2621	0.2589	0.2557	0.2397	0.2366	0.2206	0.2206	0.2174	0.2270	0.2366	0.2429	0.2493 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			11.4500	1.1450	13.1107		
Ground Floor			50.1300	0.1500	7.5195	110.0000	5514.3000 (28a)
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330	60.0000	2811.0000 (29a)
Flat Roof	4.4600		4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			112.8900				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.7322	
Party Ceiling 1			50.1300			0.0000	0.0000 (32b)
Internal Wall 1			44.0000			9.0000	396.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8761.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							174.7744 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					5.4500	0.0880	0.4796
E3 Sill					0.0000	0.0470	0.0000

# Full SAP Calculation Printout



E4 Jamb	12.6000	0.0400	0.5040	
E5 Ground floor (normal)	25.3500	0.0330	0.8366	
E14 Flat roof	7.2300	0.0490	0.3543	
E16 Corner (normal)	9.2000	0.0350	0.3220	
E17 Corner (inverted - internal area greater than external area)	2.3000	0.0350	0.0805	
E7 Party floor between dwellings (in blocks of flats)	25.3500	0.0310	0.7859	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.3628 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		33.0950 (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	9.9711	9.8498	9.7286	9.1222	9.0009	8.3945	8.3945	8.2732	8.6370	9.0009	9.2434	9.4860 (38)
Average = Sum(39)m / 12 =	43.0661	42.9448	42.8235	42.2171	42.0958	41.4894	41.4894	41.3682	41.7320	42.0958	42.3384	42.5810 (39)
HLP	0.8591	0.8567	0.8542	0.8422	0.8397	0.8276	0.8276	0.8252	0.8325	0.8397	0.8446	0.8494 (40)
HLP (average)												0.8415
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6939 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	52.6211	51.8303	50.6780	48.4732	46.8461	45.0316	44.0002	45.1438	46.3975	48.3457	50.5978	52.4195 (42a)
Hot water usage for baths	22.7520	22.4141	21.9383	21.0609	20.4040	19.6755	19.2821	19.7546	20.2690	21.0485	21.9439	22.6751 (42b)
Hot water usage for other uses	31.9775	30.8147	29.6519	28.4891	27.3262	26.1634	26.1634	27.3262	28.4891	29.6519	30.8147	31.9775 (42c)
Average daily hot water use (litres/day)												98.6801 (43)
Daily hot water use	107.3507	105.0591	102.2682	98.0232	94.5763	90.8706	89.4457	92.2247	95.1556	99.0461	103.3565	107.0721 (44)
Energy content (annual)	170.0172	149.6028	157.1823	134.1888	127.3179	111.7359	108.1768	114.1934	117.3363	134.4046	147.2503	167.6491 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5026	22.4404	23.5774	20.1283	19.0977	16.7604	16.2265	17.1290	17.6004	20.1607	22.0875	25.1474 (46)
Water storage loss:												150.0000 (47)
Store volume												1.4500 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7830 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (56)
If cylinder contains dedicated solar storage	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (64)
12Total per year (kWh/year)												2198.7466 (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	94.5590	84.0911	90.2914	81.4194	80.3615	73.9538	73.9971	75.9976	75.8159	82.7179	85.7623	93.7716 (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
Metabolic gains	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.4329	82.4079	74.4329	76.9140	74.4329	76.9140	74.4329	74.4329	76.9140	74.4329	76.9140	74.4329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.5716	149.1029	145.2440	137.0288	126.6587	116.9122	110.4010	108.8696	112.7285	120.9437	131.3138	141.0603 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696 (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)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)	127.0955	125.1356	121.3595	113.0825	108.0128	102.7136	99.4585	102.1473	105.2999	111.1799	119.1143	126.0371 (72)
Total internal gains	397.5089	405.0553	389.4453	375.4343	357.5134	344.9488	332.7013	333.8588	343.3514	354.9654	375.7511	389.9393 (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	5.6700	10.6334	0.7600	0.7000	0.7700	22.2280 (74)						
South	5.7800	46.7521	0.7600	0.7000	0.7700	99.6262 (78)						
Solar gains	121.8542	205.6408	280.0213	350.8463	400.9694	402.7724	386.2711	347.3728	303.8988	226.5510	145.5121	104.6165 (83)
Total gains	519.3631	610.6961	669.4666	726.2805	758.4828	747.7212	718.9724	681.2317	647.2502	581.5164	521.2632	494.5558 (84)

# Full SAP Calculation Printout



## 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	56.5116	56.6712	56.8317	57.6480	57.8141	58.6591	58.6591	58.8311	58.3181	57.8141	57.4829	57.1554
alpha	4.7674	4.7781	4.7888	4.8432	4.8543	4.9106	4.9106	4.9221	4.8879	4.8543	4.8322	4.8104
util living area	0.9305	0.8740	0.7947	0.6598	0.5059	0.3537	0.2537	0.2790	0.4401	0.6950	0.8747	0.9408 (86)
Living	20.4015	20.5784	20.7341	20.8643	20.9185	20.9345	20.9366	20.9365	20.9296	20.8597	20.6350	20.3686
Non living	19.5166	19.7305	19.9135	20.0663	20.1225	20.1470	20.1484	20.1505	20.1391	20.0668	19.8113	19.4837
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.2024	20.2045	20.2066	20.2169	20.2190	20.2294	20.2294	20.2315	20.2253	20.2190	20.2149	20.2107 (88)
util rest of house	0.9189	0.8558	0.7688	0.6254	0.4662	0.3117	0.2094	0.2325	0.3924	0.6548	0.8536	0.9306 (89)
MIT 2	20.2024	20.2045	20.2066	20.2169	20.2190	20.2294	20.2294	20.2315	20.2253	20.2190	20.2149	20.2107 (90)
Living area fraction									fLA = Living area / (4) =			0.5556 (91)
MIT	20.6455	20.6464	20.6474	20.6520	20.6529	20.6575	20.6575	20.6585	20.6557	20.6529	20.6511	20.6492 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6455	20.6464	20.6474	20.6520	20.6529	20.6575	20.6575	20.6585	20.6557	20.6529	20.6511	20.6492 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9256	0.8662	0.7835	0.6448	0.4884	0.3351	0.2340	0.2584	0.4190	0.6776	0.8657	0.9365 (94)
Useful gains	480.7210	528.9978	524.5431	468.3056	370.4128	250.5333	168.2414	175.9967	271.2198	394.0159	451.2607	463.1475 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.4000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	703.9375	676.2278	605.8399	496.1347	376.8800	251.3236	168.3447	176.1646	273.5816	423.1854	573.7300	700.4231 (97)
Space heating kWh	166.0731	98.9386	60.4848	20.0370	4.8116	0.0000	0.0000	0.0000	0.0000	21.7021	88.1779	176.5331 (98a)
Space heating requirement - total per year (kWh/year)												636.7581
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	166.0731	98.9386	60.4848	20.0370	4.8116	0.0000	0.0000	0.0000	0.0000	21.7021	88.1779	176.5331 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												636.7581
Space heating per m2												(98c) / (4) = 12.7021 (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 %)												115.3374 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	166.0731	98.9386	60.4848	20.0370	4.8116	0.0000	0.0000	0.0000	0.0000	21.7021	88.1779	176.5331 (98)
Space heating efficiency (main heating system 1)	115.3374	115.3374	115.3374	115.3374	115.3374	0.0000	0.0000	0.0000	0.0000	115.3374	115.3374	115.3374 (210)
Space heating fuel (main heating system)	143.9890	85.7819	52.4416	17.3725	4.1718	0.0000	0.0000	0.0000	0.0000	18.8162	76.4522	153.0580 (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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (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	13.2013	11.9237	13.2013	12.7754	13.2013	12.7754	13.2013	13.2013	12.7754	13.2013	12.7754	13.2013 (231)
Lighting	15.0184	12.0483	10.8482	7.9478	6.1391	5.0157	5.6003	7.2795	9.4554	12.4060	14.0125	15.4358 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-35.5955	-56.1510	-90.0597	-108.2019	-121.2734	-114.6166	-112.7266	-104.0922	-86.8837	-66.0751	-40.4144	-29.8487 (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)	-11.9144	-30.6049	-75.9051	-137.9356	-201.4093	-209.7686	-204.3917	-160.9465	-103.7771	-49.9394	-17.4533	-8.8655 (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												552.0831 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000
Water heating fuel used												2198.7466 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1050)												
mechanical ventilation fans (SFP = 1.1050)												155.4346 (230a)

# Full SAP Calculation Printout



Total electricity for the above, kWh/year	155.4346 (231)
Electricity for lighting (calculated in Appendix L)	121.2071 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2178.8502 (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	848.6211 (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	552.0831	0.1581	87.3055 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2198.7466	0.1408	309.6904 (264)
Space and water heating			396.9960 (265)
Pumps, fans and electric keep-hot	155.4346	0.1387	21.5607 (267)
Energy for lighting	121.2071	0.1443	17.4939 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-965.9388	0.1331	-128.5252
PV Unit electricity exported	-1212.9114	0.1216	-147.5303
Total			-276.0555 (269)
Total CO2, kg/year			159.9951 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.1900 (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	552.0831	1.5854	875.2497 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2198.7466	1.5208	3343.8640 (278)
Space and water heating			4219.1137 (279)
Pumps, fans and electric keep-hot	155.4346	1.5128	235.1414 (281)
Energy for lighting	121.2071	1.5338	185.9115 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-965.9388	1.4917	-1440.8723
PV Unit electricity exported	-1212.9114	0.4463	-541.3071
Total			-1982.1793 (283)
Total Primary energy kWh/year			2657.9872 (286)
Dwelling Primary energy Rate (DPER)			53.0200 (287)

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

-----  
 1. Overall dwelling characteristics  
 -----

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.1300 (1b)	x 2.3000 (2b)	= 115.2990 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 115.2990 (5)

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

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1735 (8)
Pressure Test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4235 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3599 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												

# Full SAP Calculation Printout



Effective ac	0.4589	0.4499	0.4409	0.3959	0.3869	0.3419	0.3419	0.3329	0.3599	0.3869	0.4049	0.4229 (22b)
	0.6053	0.6012	0.5972	0.5784	0.5749	0.5585	0.5585	0.5554	0.5648	0.5749	0.5820	0.5894 (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 Opening Type (Uw = 1.20)			11.4500	1.1450	13.1107		(27)
Ground Floor			50.1300	0.1300	6.5169		(28a)
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330		(29a)
Flat Roof	4.4600		4.4600	0.1100	0.4906		(30)
Total net area of external elements Aum(A, m2)			112.8900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) =	28.5512	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 174.7744 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.4500	0.0500	0.2725
E3 Sill	0.0000	0.0500	0.0000
E4 Jamb	12.6000	0.0500	0.6300
E5 Ground floor (normal)	25.3500	0.1600	4.0560
E14 Flat roof	7.2300	0.0800	0.5784
E16 Corner (normal)	9.2000	0.0900	0.8280
E17 Corner (inverted - internal area greater than external area)	2.3000	-0.0900	-0.2070
E7 Party floor between dwellings (in blocks of flats)	25.3500	0.0700	1.7745

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9324 (36)

#### Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 36.4836 (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	23.0311	22.8755	22.7230	22.0067	21.8727	21.2488	21.2488	21.1333	21.4891	21.8727	22.1438	22.4273 (38)
Average = Sum(39)m / 12 =	59.5147	59.3591	59.2066	58.4903	58.3563	57.7324	57.7324	57.6168	57.9727	58.3563	58.6274	58.9108 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1872	1.1841	1.1811	1.1668	1.1641	1.1517	1.1517	1.1493	1.1564	1.1641	1.1695	1.1752 (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	52.6211	51.8303	50.6780	48.4732	46.8461	45.0316	44.0002	45.1438	46.3975	48.3457	50.5978	52.4195 (42a)
Hot water usage for baths	22.7520	22.4141	21.9383	21.0609	20.4040	19.6755	19.2821	19.7546	20.2690	21.0485	21.9439	22.6751 (42b)
Hot water usage for other uses	31.9775	30.8147	29.6519	28.4891	27.3262	26.1634	26.1634	27.3262	28.4891	29.6519	30.8147	31.9775 (42c)
Average daily hot water use (litres/day)												98.6801 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.3507	105.0591	102.2682	98.0232	94.5763	90.8706	89.4457	92.2247	95.1556	99.0461	103.3565	107.0721 (44)
Energy content (annual)	170.0172	149.6028	157.1823	134.1888	127.3179	111.7359	108.1768	114.1934	117.3363	134.4046	147.2503	167.6491 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5026	22.4404	23.5774	20.1283	19.0977	16.7604	16.2265	17.1290	17.6004	20.1607	22.0875	25.1474 (46)

Water storage loss: Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)

If cylinder contains dedicated solar storage 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (58)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Total heat required for water heating calculated for each month 216.6121 191.6885 203.7772 179.2807 173.9128 156.8278 154.7717 160.7883 162.4282 180.9995 192.3421 214.2440 (62)

WWHRS -24.0562 -21.2755 -22.2785 -18.4474 -17.1924 -14.7116 -13.7898 -14.6641 -15.2212 -17.9441 -20.3285 -23.6107 (63a)

FV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 192.5559 170.4131 181.4988 160.8332 156.7205 142.1162 140.9819 146.1242 147.2070 163.0554 172.0136 190.6333 (64)

Total per year (kWh/year) = Sum(64a)m = 1964.1531 (64)

12Total per year (kWh/year) 1964 (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) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 93.8066 83.4115 89.5391 80.6913 79.6091 73.2257 73.2447 75.2452 75.0878 81.9655 85.0342 93.0192 (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	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.4329	82.4079	74.4329	76.9140	74.4329	76.9140	74.4329	74.4329	76.9140	74.4329	76.9140	74.4329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.5716	149.1029	145.2440	137.0288	126.6587	116.9122	110.4010	108.8696	112.7285	120.9437	131.3138	141.0603 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)												



# Full SAP Calculation Printout



Total internal gains	126.0842	124.1243	120.3482	112.0712	107.0015	101.7023	98.4472	101.1361	104.2886	110.1686	118.1030	125.0259 (72)
	399.4976	407.0440	391.4340	377.4230	359.5021	343.9375	331.6900	332.8475	342.3401	356.9542	377.7398	391.9280 (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			5.6700	10.6334	0.6300	0.7000	0.7700	18.4258 (74)				
South			5.7800	46.7521	0.6300	0.7000	0.7700	82.5849 (78)				
Solar gains	101.0107	170.4654	232.1229	290.8331	332.3825	333.8771	320.1984	287.9538	251.9161	187.7988	120.6218	86.7216 (83)
Total gains	500.5083	577.5094	623.5570	668.2561	691.8846	677.8146	651.8884	620.8013	594.2562	544.7530	498.3617	478.6496 (84)

## 7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	40.8930	41.0002	41.1058	41.6092	41.7047	42.1554	42.1554	42.2400	41.9807	41.7047	41.5119	41.3121
alpha	3.7262	3.7333	3.7404	3.7739	3.7803	3.8104	3.8104	3.8160	3.7987	3.7803	3.7675	3.7541
util living area	0.9599	0.9335	0.8939	0.8126	0.6861	0.5191	0.3830	0.4173	0.6156	0.8312	0.9326	0.9651 (86)
MIT	19.5720	19.8406	20.1615	20.5397	20.8098	20.9506	20.9879	20.9832	20.9042	20.5691	20.0221	19.5281 (87)
Th 2	19.9302	19.9327	19.9352	19.9467	19.9488	19.9589	19.9589	19.9607	19.9550	19.9488	19.9445	19.9399 (88)
util rest of house	0.9515	0.9203	0.8730	0.7770	0.6305	0.4436	0.2954	0.3272	0.5399	0.7914	0.9170	0.9578 (89)
MIT 2	18.3102	18.6441	19.0379	19.4917	19.7869	19.9277	19.9540	19.9535	19.8881	19.5382	18.8835	18.2621 (90)
Living area fraction										fLA = Living area / (4) =		
MIT	19.0112	19.3089	19.6621	20.0739	20.3551	20.4960	20.5284	20.5255	20.4526	20.1109	19.5161	18.9654 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0112	19.3089	19.6621	20.0739	20.3551	20.4960	20.5284	20.5255	20.4526	20.1109	19.5161	18.9654 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9426	0.9112	0.8670	0.7817	0.6529	0.4834	0.3438	0.3768	0.5772	0.7981	0.9095	0.9493 (94)
Useful gains	471.7803	526.2254	540.5977	522.3453	451.7290	327.6445	224.1318	233.9002	342.9866	434.7828	453.2394	454.3721 (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	875.5333	855.2968	779.2846	653.5653	505.0819	340.3892	226.7953	237.6994	368.2784	555.0218	727.9233	869.8435 (97)
Space heating kWh	300.3922	221.1360	177.5830	94.4784	39.6946	0.0000	0.0000	0.0000	0.0000	89.4579	197.7724	309.1107 (98a)
Space heating requirement - total per year (kWh/year)												1429.6251
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	300.3922	221.1360	177.5830	94.4784	39.6946	0.0000	0.0000	0.0000	0.0000	89.4579	197.7724	309.1107 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1429.6251
Space heating per m2												28.5184 (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 %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	300.3922	221.1360	177.5830	94.4784	39.6946	0.0000	0.0000	0.0000	0.0000	89.4579	197.7724	309.1107 (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)	325.4520	239.5839	192.3976	102.3601	43.0060	0.0000	0.0000	0.0000	0.0000	96.9208	214.2713	334.8979 (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	192.5559	170.4131	181.4988	160.8332	156.7205	142.1162	140.9819	146.1242	147.2070	163.0554	172.0136	190.6333 (64)
Efficiency of water heater (217)m	85.0530	84.6451	84.0109	82.9095	81.4687	79.8000	79.8000	79.8000	79.8000	82.7720	84.3735	79.8000 (216)
Fuel for water heating, kWh/month	226.3953	201.3265	216.0420	193.9864	192.3690	178.0904	176.6691	183.1131	184.4699	196.9934	203.8715	223.9130 (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	15.4657	12.4072	11.1713	8.1845	6.3220	5.1651	5.7671	7.4963	9.7370	12.7754	14.4298	15.8955 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-23.8912	-33.9141	-49.1052	-55.6681	-60.4670	-56.6550	-56.0044	-52.6772	-46.8376	-39.0317	-26.3662	-20.6322 (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)												

# Full SAP Calculation Printout



(233b)m	-12.8089	-27.0200	-53.8215	-80.9870	-107.2015	-107.7046	-106.3890	-89.9873	-65.8693	-38.6366	-17.1054	-10.1195	(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												1548.8896	(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												2377.2396	(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)												124.8170	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1238.9004	(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												2898.0457	(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	1548.8896	0.2100	325.2668	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2377.2396	0.2100	499.2203	(264)
Space and water heating			824.4871	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.8170	0.1443	18.0149	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-521.2498	0.1344	-70.0576	
PV Unit electricity exported	-717.6507	0.1259	-90.3183	
Total			-160.3758	(269)
Total CO2, kg/year			694.0555	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8500	(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	1548.8896	1.1300	1750.2452	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2377.2396	1.1300	2686.2807	(278)
Space and water heating			4436.5259	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.8170	1.5338	191.4484	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-521.2498	1.4967	-780.1651	
PV Unit electricity exported	-717.6507	0.4620	-331.5295	
Total			-1111.6946	(283)
Total Primary energy kWh/year			3646.3806	(286)
Target Primary Energy Rate (TPER)			72.7400	(287)

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

### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	50.1300	2.3000	115.2990	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300			(4)
Dwelling volume			115.2990	(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)

# Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1735 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3235	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2749	(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	0.3506	0.3437	0.3368	0.3024	0.2956	0.2612	0.2612	0.2543	0.2749	0.2956	0.3093	0.3231 (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	0.5614	0.5591	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			11.4500	1.1450	13.1107		
Ground Floor			50.1300	0.1500	7.5195	110.0000	5514.3000 (28a)
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330	60.0000	2811.0000 (29a)
Flat Roof	4.4600		4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m2)			112.8900				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.7322	
Party Ceiling 1			50.1300			0.0000	0.0000 (32b)
Internal Wall 1			44.0000			9.0000	396.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8761.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							174.7744 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.4500	0.0880	0.4796	
E3 Sill				0.0000	0.0470	0.0000	
E4 Jamb				12.6000	0.0400	0.5040	
E5 Ground floor (normal)				25.3500	0.0330	0.8366	
E14 Flat roof				7.2300	0.0490	0.3543	
E16 Corner (normal)				9.2000	0.0350	0.3220	
E17 Corner (inverted - internal area greater than external area)				2.3000	0.0350	0.0805	
E7 Party floor between dwellings (in blocks of flats)				25.3500	0.0310	0.7859	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3628 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 33.0950 (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
	21.3622	21.2714	21.1824	20.7645	20.6863	20.3222	20.3222	20.2548	20.4625	20.6863	20.8445	21.0098 (38)
Heat transfer coeff	54.4571	54.3663	54.2774	53.8594	53.7812	53.4172	53.4172	53.3498	53.5574	53.7812	53.9394	54.1048 (39)
Average = Sum(39)m / 12 =												53.8590
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.0863	1.0845	1.0827	1.0744	1.0728	1.0656	1.0656	1.0642	1.0684	1.0728	1.0760	1.0793 (40)
HLP (average)												1.0744
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy												1.6939 (42)
Hot water usage for mixer showers												0.0000 (42a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for baths												22.6751 (42b)
	22.7520	22.4141	21.9383	21.0609	20.4040	19.6755	19.2821	19.7546	20.2690	21.0485	21.9439	22.6751
Hot water usage for other uses												31.9775 (42c)
	31.9775	30.8147	29.6519	28.4891	27.3262	26.1634	26.1634	27.3262	28.4891	29.6519	30.8147	31.9775
Average daily hot water use (litres/day)												50.1652 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	54.7296	53.2288	51.5902	49.5500	47.7302	45.8390	45.4455	47.0808	48.7581	50.7004	52.7586	54.6526 (44)
Energy conte	86.6782	75.7972	79.2922	67.8315	64.2541	56.3644	54.9624	58.2959	60.1236	68.8000	75.1644	85.5728 (45)
Energy content (annual)										Total = Sum(45)m =		833.1365
Distribution loss (46)m = 0.15 x (45)m												0.0000 (46)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:												
Total storage loss												0.0000 (56)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage												0.0000 (57)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primary loss												0.0000 (59)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss												0.0000 (61)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month												
	73.6765	64.4276	67.3984	57.6568	54.6160	47.9097	46.7180	49.5515	51.1051	58.4800	63.8897	72.7369 (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	73.6765	64.4276	67.3984	57.6568	54.6160	47.9097	46.7180	49.5515	51.1051	58.4800	63.8897	72.7369 (64)
12Total per year (kWh/year)												708.1661 (64)
Electric shower(s)												708 (64)
	42.1407	37.5477	41.0007	39.1265	39.8607	38.0232	39.2906	39.8607	39.1265	41.0007	40.2297	42.1407 (64a)
Total Energy used by instantaneous electric shower (s) = Sum(64a)m =												479.3484 (64a)
Heat gains from water heating, kWh/month	28.9543	25.4938	27.0998	24.1958	23.6192	21.4832	21.5022	22.3530	22.5579	24.8702	26.0299	28.7194 (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	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.4329	82.4079	74.4329	76.9140	74.4329	76.9140	74.4329	74.4329	76.9140	74.4329	76.9140	74.4329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.5716	149.1029	145.2440	137.0288	126.6587	116.9122	110.4010	108.8696	112.7285	120.9437	131.3138	141.0603 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696 (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)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)	38.9171	37.9372	36.4244	33.6053	31.7462	29.8378	28.9008	30.0444	31.3304	33.4276	36.1526	38.6014 (72)
Total internal gains	309.3305	317.8570	304.5103	295.9571	281.2467	272.0730	262.1436	261.7559	269.3819	277.2132	292.7894	302.5035 (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	FF	Access factor Table 6d	Gains W					
North	5.6700	10.6334	0.7600	0.7000	0.7700	22.2280 (74)						
South	5.7800	46.7521	0.7600	0.7000	0.7700	99.6262 (78)						
Solar gains	121.8542	205.6408	280.0213	350.8463	400.9694	402.7724	386.2711	347.3728	303.8988	226.5510	145.5121	104.6165 (83)
Total gains	431.1847	523.4978	584.5316	646.8033	682.2161	674.8454	648.4147	609.1287	573.2807	503.7642	438.3014	407.1201 (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)												
tau	44.6908	44.7654	44.8388	45.1868	45.2525	45.5609	45.5609	45.6184	45.4416	45.2525	45.1198	44.9818
alpha	3.9794	3.9844	3.9893	4.0125	4.0168	4.0374	4.0374	4.0412	4.0294	4.0168	4.0080	3.9988
util living area	0.9723	0.9438	0.8984	0.8035	0.6619	0.4900	0.3586	0.3967	0.6007	0.8402	0.9482	0.9774 (86)
MIT	19.6034	19.9134	20.2533	20.6228	20.8611	20.9679	20.9928	20.9892	20.9280	20.6111	20.0455	19.5414 (87)
Th 2	20.0120	20.0135	20.0150	20.0218	20.0231	20.0290	20.0290	20.0302	20.0267	20.0231	20.0205	20.0178 (88)
util rest of house	0.9664	0.9327	0.8789	0.7687	0.6089	0.4215	0.2813	0.3158	0.5296	0.8031	0.9359	0.9725 (89)
MIT 2	18.7615	19.0631	19.3881	19.7308	19.9310	20.0132	20.0268	20.0265	19.9873	19.7308	19.2015	18.7052 (90)
Living area fraction												
MIT	19.2292	19.5355	19.8688	20.2264	20.4477	20.5436	20.5635	20.5613	20.5099	20.2199	19.6704	19.1697 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2292	19.5355	19.8688	20.2264	20.4477	20.5436	20.5635	20.5613	20.5099	20.2199	19.6704	19.1697 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9607	0.9263	0.8756	0.7764	0.6327	0.4583	0.3241	0.3605	0.5659	0.8112	0.9307	0.9672 (94)
Useful gains	414.2312	484.9387	511.8438	502.1843	431.6233	309.2996	210.1572	219.6033	324.4224	408.6500	407.9180	393.7539 (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	813.0021	795.6785	725.6207	610.0318	470.4620	317.4905	211.7170	222.0062	343.2989	517.3680	678.0388	809.9351 (97)
Space heating kWh	296.6856	208.8171	159.0500	77.6502	28.8960	0.0000	0.0000	0.0000	0.0000	80.8862	194.4870	309.6388 (98a)
Space heating requirement - total per year (kWh/year)												1356.1109
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	296.6856	208.8171	159.0500	77.6502	28.8960	0.0000	0.0000	0.0000	0.0000	80.8862	194.4870	309.6388 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1356.1109
Space heating per m <sup>2</sup>										(98c) / (4) =		27.0519 (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	502.1216	395.2872	405.4583	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9280	0.9601	0.9480	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	465.9505	379.5300	384.3777	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	762.3553	732.9372	688.4398	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	213.4114	262.9349	226.2222	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	53.3529	65.7337	56.5555	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												175.6421 (107)
Energy for space heating												27.0519 (99)
Energy for space cooling												3.5037 (108)
Total												30.5556 (109)
Fabric Energy Efficiency (DFEE)												30.6 (109)

# Full SAP Calculation Printout



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

## 1. Overall dwelling characteristics

Ground floor		Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300	50.1300 (1b)	x 2.3000 (2b)	= 115.2990 (1b) - (3b)	(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 115.2990 (5)	

## 2. Ventilation rate

		m3 per hour										
Number of open chimneys		0 * 80 =	0.0000 (6a)									
Number of open flues		0 * 20 =	0.0000 (6b)									
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)									
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)									
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)									
Number of blocked chimneys		0 * 20 =	0.0000 (6f)									
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)									
Number of passive vents		0 * 10 =	0.0000 (7b)									
Number of flueless gas fires		0 * 40 =	0.0000 (7c)									
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1735 (8)									
Pressure test				Yes								
Pressure Test Method				Blower Door								
Measured/design AP50				5.0000 (17)								
Infiltration rate				0.4235 (18)								
Number of sides sheltered				2 (19)								
Shelter factor		(20) = 1 - [0.075 x (19)] =		0.8500 (20)								
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =		0.3599 (21)								
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4589	0.4499	0.4409	0.3959	0.3869	0.3419	0.3419	0.3329	0.3599	0.3869	0.4049	0.4229 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.6053	0.6012	0.5972	0.5784	0.5749	0.5585	0.5585	0.5554	0.5648	0.5749	0.5820	0.5894 (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 Opening Type (Uw = 1.20)			11.4500	1.1450	13.1107		(27)					
Ground Floor			50.1300	0.1300	6.5169		(28a)					
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330		(29a)					
Flat Roof	4.4600		4.4600	0.1100	0.4906		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			112.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.5512	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							174.7744 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				5.4500	0.0500	0.2725						
E3 Sill				0.0000	0.0500	0.0000						
E4 Jamb				12.6000	0.0500	0.6300						
E5 Ground floor (normal)				25.3500	0.1600	4.0560						
E14 Flat roof				7.2300	0.0800	0.5784						
E16 Corner (normal)				9.2000	0.0900	0.8280						
E17 Corner (inverted - internal area greater than external area)				2.3000	-0.0900	-0.2070						
E7 Party floor between dwellings (in blocks of flats)				25.3500	0.0700	1.7745						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9324 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 36.4836 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 23.0311	Feb 22.8755	Mar 22.7230	Apr 22.0067	May 21.8727	Jun 21.2488	Jul 21.2488	Aug 21.1333	Sep 21.4891	Oct 21.8727	Nov 22.1438	Dec 22.4273 (38)
Heat transfer coeff	59.5147	59.3591	59.2066	58.4903	58.3563	57.7324	57.7324	57.6168	57.9727	58.3563	58.6274	58.9108 (39)
Average = Sum(39)m / 12 =	58.4897											
HLP	Jan 1.1872	Feb 1.1841	Mar 1.1811	Apr 1.1668	May 1.1641	Jun 1.1517	Jul 1.1517	Aug 1.1493	Sep 1.1564	Oct 1.1641	Nov 1.1695	Dec 1.1752 (40)
HLP (average)	1.1668											
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy												1.6939 (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												

# Full SAP Calculation Printout



Hot water usage for other uses	22.7520	22.4141	21.9383	21.0609	20.4040	19.6755	19.2821	19.7546	20.2690	21.0485	21.9439	22.6751 (42b)
Average daily hot water use (litres/day)	31.9775	30.8147	29.6519	28.4891	27.3262	26.1634	26.1634	27.3262	28.4891	29.6519	30.8147	31.9775 (42c) 50.1652 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	54.7296	53.2288	51.5902	49.5500	47.7302	45.8390	45.4455	47.0808	48.7581	50.7004	52.7586	54.6526 (44)
Energy content (annual)	86.6782	75.7972	79.2922	67.8315	64.2541	56.3644	54.9624	58.2959	60.1236	68.8000	75.1644	85.5728 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	73.6765	64.4276	67.3984	57.6568	54.6160	47.9097	46.7180	49.5515	51.1051	58.4800	63.8897	72.7369 (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	73.6765	64.4276	67.3984	57.6568	54.6160	47.9097	46.7180	49.5515	51.1051	58.4800	63.8897	72.7369 (64)
12Total per year (kWh/year)												708 (64)
Electric shower(s)	42.1407	37.5477	41.0007	39.1265	39.8607	38.0232	39.2906	39.8607	39.1265	41.0007	40.2297	42.1407 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												479.3484 (64a)
Heat gains from water heating, kWh/month	28.9543	25.4938	27.0998	24.1958	23.6192	21.4832	21.5022	22.3530	22.5579	24.8702	26.0299	28.7194 (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	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964	84.6964 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.4329	82.4079	74.4329	76.9140	74.4329	76.9140	74.4329	74.4329	76.9140	74.4329	76.9140	74.4329 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.5716	149.1029	145.2440	137.0288	126.6587	116.9122	110.4010	108.8696	112.7285	120.9437	131.3138	141.0603 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696	31.4696 (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)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)	38.9171	37.9372	36.4244	33.6053	31.7462	29.8378	28.9008	30.0444	31.3304	33.4276	36.1526	38.6014 (72)
Total internal gains	309.3305	317.8570	304.5103	295.9571	281.2467	272.0730	262.1436	261.7559	269.3819	277.2132	292.7894	302.5035 (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		5.6700	10.6334	0.6300	0.7000	0.7700	18.4258 (74)					
South		5.7800	46.7521	0.6300	0.7000	0.7700	82.5849 (78)					
Solar gains	101.0107	170.4654	232.1229	290.8331	332.3825	333.8771	320.1984	287.9538	251.9161	187.7988	120.6218	86.7216 (83)
Total gains	410.3412	488.3224	536.6332	586.7902	613.6293	605.9501	582.3420	549.7097	521.2980	465.0120	413.4112	389.2251 (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	40.8930	41.0002	41.1058	41.6092	41.7047	42.1554	42.1554	42.2400	41.9807	41.7047	41.5119	41.3121	
alpha	3.7262	3.7333	3.7404	3.7739	3.7803	3.8104	3.8104	3.8160	3.7987	3.7803	3.7675	3.7541	
util living area	0.9779	0.9584	0.9275	0.8575	0.7397	0.5699	0.4256	0.4662	0.6766	0.8813	0.9602	0.9815 (86)	
MIT	19.3519	19.6427	19.9952	20.4283	20.7517	20.9323	20.9827	20.9755	20.8675	20.4489	19.8327	19.3052 (87)	
Th 2	19.9302	19.9327	19.9352	19.9467	19.9488	19.9589	19.9589	19.9607	19.9550	19.9488	19.9445	19.9399 (88)	
util rest of house	0.9730	0.9494	0.9117	0.8268	0.6861	0.4905	0.3296	0.3677	0.6001	0.8489	0.9500	0.9773 (89)	
MIT 2	18.4535	18.7396	19.0823	19.4968	19.7801	19.9247	19.9533	19.9523	19.8805	19.5270	18.9383	18.4147 (90)	
Living area fraction	fLA = Living area / (4) =												
MIT	18.9526	19.2413	19.5895	20.0143	20.3199	20.4845	20.5252	20.5207	20.4288	20.0392	19.4352	18.9094 (92)	
Temperature adjustment													
adjusted MIT	18.9526	19.2413	19.5895	20.0143	20.3199	20.4845	20.5252	20.5207	20.4288	20.0392	19.4352	18.9094 (93)	

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	396.8662	460.1486	486.0283	486.4361	433.2839	322.1848	222.7732	231.8470	331.7680	396.1958	390.2646	378.3586 (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	872.0467	851.2883	774.9854	650.0813	503.0231	339.7269	226.6104	237.4224	366.8981	550.8365	723.1808	866.5450 (97)
Space heating kWh	353.5343	262.8458	214.9840	117.8246	51.8860	0.0000	0.0000	0.0000	0.0000	115.0527	239.6997	363.2107 (98a)
Space heating requirement - total per year (kWh/year)												1719.0378

# Full SAP Calculation Printout



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	353.5343	262.8458	214.9840	117.8246	51.8860	0.0000	0.0000	0.0000	0.0000	115.0527	239.6997	363.2107	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													1719.0378	
Space heating per m2													(98c) / (4) = 34.2916	(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	542.6843	427.2196	437.8880	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8717	0.9220	0.9037	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	473.0448	393.8764	395.7313	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	681.8283	655.7094	618.9889	0.0000	0.0000	0.0000	0.0000	(103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	150.3241	194.8037	166.1037	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	37.5810	48.7009	41.5259	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling requirement													127.8079	(107)
Energy for space heating													34.2916	(99)
Energy for space cooling													2.5495	(108)
Total													36.8411	(109)
Fabric Energy Efficiency (TFEE)													36.8	(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	50.1300	2.3000	115.2990	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300		115.2990	(4)
Dwelling volume			115.2990	(5)

## 2. Ventilation rate

	m3 per hour												
Number of open chimneys	0 * 80 = 0.0000 (6a)												
Number of open flues	0 * 20 = 0.0000 (6b)												
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)												
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)												
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)												
Number of blocked chimneys	0 * 20 = 0.0000 (6f)												
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)												
Number of passive vents	0 * 10 = 0.0000 (7b)												
Number of flueless gas fires	0 * 40 = 0.0000 (7c)												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)												
Pressure test	Yes												
Pressure Test Method	Blower Door												
Measured/design AP50	3.0000 (17)												
Infiltration rate	0.1500 (18)												
Number of sides sheltered	2 (19)												
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)												
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)												
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	(22)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													
Effective ac	0.2621	0.2589	0.2557	0.2397	0.2366	0.2206	0.2206	0.2174	0.2270	0.2366	0.2429	0.2493	(25)

## 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			11.4500	1.1450	13.1107		(27)
Ground Floor			50.1300	0.1500	7.5195	110.0000	5514.3000 (28a)
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330	60.0000	2811.0000 (29a)
Flat Roof	4.4600		4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m2)			112.8900				(31)

# Full SAP Calculation Printout



Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	29.7322		(33)
Party Ceiling 1	50.1300		0.0000	0.0000 (32b)
Internal Wall 1	44.0000		9.0000	396.0000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8761.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K		174.7744 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4500	0.0880	0.4796
E3 Sill	0.0000	0.0470	0.0000
E4 Jamb	12.6000	0.0400	0.5040
E5 Ground floor (normal)	25.3500	0.0330	0.8366
E14 Flat roof	7.2300	0.0490	0.3543
E16 Corner (normal)	9.2000	0.0350	0.3220
E17 Corner (inverted - internal area greater than external area)	2.3000	0.0350	0.0805
E7 Party floor between dwellings (in blocks of flats)	25.3500	0.0310	0.7859

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.3628 (36)
Point Thermal bridges		0.0000
Total fabric heat loss	(33) + (36) + (36a) =	33.0950 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 9.9711	Feb 9.8498	Mar 9.7286	Apr 9.1222	May 9.0009	Jun 8.3945	Jul 8.3945	Aug 8.2732	Sep 8.6370	Oct 9.0009	Nov 9.2434	Dec 9.4860 (38)
Heat transfer coeff	43.0661	42.9448	42.8235	42.2171	42.0958	41.4894	41.4894	41.3682	41.7320	42.0958	42.3384	42.5810 (39)
Average = Sum(39)m / 12 =												42.1868
HLP	Jan 0.8591	Feb 0.8567	Mar 0.8542	Apr 0.8422	May 0.8397	Jun 0.8276	Jul 0.8276	Aug 0.8252	Sep 0.8325	Oct 0.8397	Nov 0.8446	Dec 0.8494 (40)
HLP (average)												0.8415
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													1.6939 (42)
Hot water usage for mixer showers	52.6211	51.8303	50.6780	48.4732	46.8461	45.0316	44.0002	45.1438	46.3975	48.3457	50.5978	52.4195 (42a)	
Hot water usage for baths	22.7520	22.4141	21.9383	21.0609	20.4040	19.6755	19.2821	19.7546	20.2690	21.0485	21.9439	22.6751 (42b)	
Hot water usage for other uses	31.9775	30.8147	29.6519	28.4891	27.3262	26.1634	26.1634	27.3262	28.4891	29.6519	30.8147	31.9775 (42c)	
Average daily hot water use (litres/day)													98.6801 (43)
Daily hot water use	Jan 107.3507	Feb 105.0591	Mar 102.2682	Apr 98.0232	May 94.5763	Jun 90.8706	Jul 89.4457	Aug 92.2247	Sep 95.1556	Oct 99.0461	Nov 103.3565	Dec 107.0721 (44)	
Energy conte	170.0172	149.6028	157.1823	134.1888	127.3179	111.7359	108.1768	114.1934	117.3363	134.4046	147.2503	167.6491 (45)	
Energy content (annual)										Total = Sum(45)m =		1639.0556	
Distribution loss (46)m = 0.15 x (45)m	25.5026	22.4404	23.5774	20.1283	19.0977	16.7604	16.2265	17.1290	17.6004	20.1607	22.0875	25.1474 (46)	
Water storage loss:													150.0000 (47)
Store volume													1.4500 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7830 (55)
Enter (49) or (54) in (55)													
Total storage loss	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (56)	
If cylinder contains dedicated solar storage	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (64)	
									Total per year (kWh/year) = Sum(64)m =			2198.7466 (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)	
												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	94.5590	84.0911	90.2914	81.4194	80.3615	73.9538	73.9971	75.9976	75.8159	82.7179	85.7623	93.7716 (65)	

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

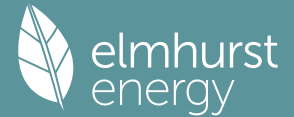
Metabolic gains (Table 5), Watts	Jan 101.6357	Feb 101.6357	Mar 101.6357	Apr 101.6357	May 101.6357	Jun 101.6357	Jul 101.6357	Aug 101.6357	Sep 101.6357	Oct 101.6357	Nov 101.6357	Dec 101.6357 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1581	15.2397	12.3937	9.3829	7.0138	5.9213	6.3982	8.3167	11.1626	14.1735	16.5425	17.6350 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.2561	222.5417	216.7821	204.5207	189.0428	174.4958	164.7776	162.4920	168.2515	180.5130	195.9908	210.5378 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575 (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)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)	127.0955	125.1356	121.3595	113.0825	108.0128	102.7136	99.4585	102.1473	105.2999	111.1799	119.1143	126.0371 (72)
Total internal gains	445.2458	443.6530	431.2714	407.7221	384.8055	363.8669	351.3704	353.6921	365.4501	386.6024	412.3837	434.9460 (73)

## 6. Solar gains

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



# Full SAP Calculation Printout



North			5.6700	10.6334	0.7600	0.7000	0.7700					22.2280 (74)
South			5.7800	46.7521	0.7600	0.7000	0.7700					99.6262 (78)

Solar gains	121.8542	205.6408	280.0213	350.8463	400.9694	402.7724	386.2711	347.3728	303.8988	226.5510	145.5121	104.6165 (83)
Total gains	567.0999	649.2938	711.2927	758.5684	785.7749	766.6393	737.6414	701.0649	669.3489	613.1534	557.8958	539.5625 (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	56.5116	56.6712	56.8317	57.6480	57.8141	58.6591	58.6591	58.8311	58.3181	57.8141	57.4829	57.1554
alpha	4.7674	4.7781	4.7888	4.8432	4.8543	4.9106	4.9106	4.9221	4.8879	4.8543	4.8322	4.8104
util living area	0.9087	0.8519	0.7667	0.6374	0.4896	0.3451	0.2473	0.2711	0.4262	0.6678	0.8499	0.9215 (86)
Living	20.4739	20.6222	20.7642	20.8741	20.9208	20.9348	20.9366	20.9366	20.9306	20.8718	20.6763	20.4410
Non living	19.6038	19.7814	19.9466	20.0760	20.1244	20.1471	20.1484	20.1506	20.1398	20.0785	19.8585	19.5715
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.2024	20.2045	20.2066	20.2169	20.2190	20.2294	20.2294	20.2315	20.2253	20.2190	20.2149	20.2107 (88)
util rest of house	0.8945	0.8319	0.7396	0.6032	0.4508	0.3040	0.2041	0.2260	0.3798	0.6276	0.8266	0.9089 (89)
MIT 2	20.2024	20.2045	20.2066	20.2169	20.2190	20.2294	20.2294	20.2315	20.2253	20.2190	20.2149	20.2107 (90)
Living area fraction									FLA = Living area / (4) =			0.5556 (91)
MIT	20.6455	20.6464	20.6474	20.6520	20.6529	20.6575	20.6575	20.6585	20.6557	20.6529	20.6511	20.6492 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6455	20.6464	20.6474	20.6520	20.6529	20.6575	20.6575	20.6585	20.6557	20.6529	20.6511	20.6492 (93)

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	511.8943	547.5473	536.9958	472.1736	371.2635	250.6159	168.2529	176.0174	271.5311	398.7215	468.5885	494.3046 (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	703.9375	676.2278	605.8399	496.1347	376.8800	251.3236	168.3447	176.1646	273.5816	423.1854	573.7300	700.4231 (97)
Space heating kWh	142.8801	86.4733	51.2200	17.2520	4.1787	0.0000	0.0000	0.0000	0.0000	18.2012	75.7019	153.3521 (98a)
Space heating requirement - total per year (kWh/year)												549.2593
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	142.8801	86.4733	51.2200	17.2520	4.1787	0.0000	0.0000	0.0000	0.0000	18.2012	75.7019	153.3521 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												549.2593
Space heating per m2										(98c) / (4) =		10.9567 (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 %)												115.3374 (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	142.8801	86.4733	51.2200	17.2520	4.1787	0.0000	0.0000	0.0000	0.0000	18.2012	75.7019	153.3521 (98)
Space heating efficiency (main heating system 1)	115.3374	115.3374	115.3374	115.3374	115.3374	0.0000	0.0000	0.0000	0.0000	115.3374	115.3374	115.3374 (210)
Space heating fuel (main heating system)	123.8802	74.9742	44.4089	14.9579	3.6230	0.0000	0.0000	0.0000	0.0000	15.7808	65.6352	132.9596 (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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (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	13.2013	11.9237	13.2013	12.7754	13.2013	12.7754	13.2013	13.2013	12.7754	13.2013	12.7754	13.2013 (221)
Lighting	15.0184	12.0483	10.8482	7.9478	6.1391	5.0157	5.6003	7.2795	9.4554	12.4060	14.0125	15.4358 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-35.4054	-55.8571	-89.5613	-107.9127	-121.1796	-114.6166	-112.7266	-104.0922	-86.8837	-65.9211	-40.2344	-29.7051 (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)	-12.1044	-30.8988	-76.4035	-138.2248	-201.5031	-209.7686	-204.3917	-160.9465	-103.7771	-50.0935	-17.6332	-9.0091 (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												476.2197 (211)

# Full SAP Calculation Printout



Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	100.0000	
Water heating fuel used	2198.7466	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1050)		
mechanical ventilation fans (SFP = 1.1050)	155.4346	(230a)
Total electricity for the above, kWh/year	155.4346	(231)
Electricity for lighting (calculated in Appendix L)	121.2071	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2178.8502	(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	772.7578	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	476.2197	16.4900	78.5286	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2198.7466	16.4900	362.5733	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	155.4346	16.4900	25.6312	(249)
Energy for lighting	121.2071	16.4900	19.9870	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-964.0959	16.4900	-158.9794	
PV Unit electricity exported	-1214.7543	5.5900	-67.9048	
Total			-226.8842	(252)
Total energy cost			259.8360	(255)

## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9833	(257)
SAP value		84.0608	
SAP rating (Section 12)		84	(258)
SAP band		B	

## 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	476.2197	0.1582	75.3296	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2198.7466	0.1408	309.6904	(264)
Space and water heating			385.0200	(265)
Pumps, fans and electric keep-hot	155.4346	0.1387	21.5607	(267)
Energy for lighting	121.2071	0.1443	17.4939	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-964.0959	0.1330	-128.2457	
PV Unit electricity exported	-1214.7543	0.1217	-147.8469	
Total			-276.0926	(269)
Total CO2, kg/year			147.9821	(272)
CO2 emissions per m2			2.9500	(273)
EI value			97.9155	
EI rating			98	(274)
EI band			A	

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

## 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	50.1300 (1b)	x 2.3000 (2b)	= 115.2990 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	115.2990 (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)

# Full SAP Calculation Printout



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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)

Pressure test Yes

Pressure Test Method Blower Door

Measured/design AP50 3.0000 (17)

Infiltration rate 0.1500 (18)

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.9000	6.5000	6.3000	5.6000	5.6000	4.9000	4.8000	4.7000	5.2000	6.0000	6.3000	6.9000 (22)
Wind factor	1.7250	1.6250	1.5750	1.4000	1.4000	1.2250	1.2000	1.1750	1.3000	1.5000	1.5750	1.7250 (22a)
Adj infilt rate	0.2199	0.2072	0.2008	0.1785	0.1785	0.1562	0.1530	0.1498	0.1658	0.1913	0.2008	0.2199 (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) =												80.1000 (23c)
Effective ac	0.3194	0.3067	0.3003	0.2780	0.2780	0.2557	0.2525	0.2493	0.2652	0.2907	0.3003	0.3194 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			11.4500	1.1450	13.1107		(27)
Ground Floor			50.1300	0.1500	7.5195	110.0000	5514.3000 (28a)
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330	60.0000	2811.0000 (29a)
Flat Roof	4.4600		4.4600	0.1500	0.6690	9.0000	40.1400 (30)
Total net area of external elements Aum(A, m2)			112.8900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 29.7322		(33)
Party Ceiling 1			50.1300			0.0000	0.0000 (32b)
Internal Wall 1			44.0000			9.0000	396.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8761.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							174.7744 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.4500	0.0880	0.4796
E3 Sill	0.0000	0.0470	0.0000
E4 Jamb	12.6000	0.0400	0.5040
E5 Ground floor (normal)	25.3500	0.0330	0.8366
E14 Flat roof	7.2300	0.0490	0.3543
E16 Corner (normal)	9.2000	0.0350	0.3220
E17 Corner (inverted - internal area greater than external area)	2.3000	0.0350	0.0805
E7 Party floor between dwellings (in blocks of flats)	25.3500	0.0310	0.7859
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.3628 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 33.0950 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	12.1542	11.6691	11.4265	10.5775	10.5775	9.7286	9.6073	9.4860	10.0924	11.0627	11.4265	12.1542 (38)
Heat transfer coeff	45.2491	44.7640	44.5214	43.6725	43.6725	42.8235	42.7022	42.5810	43.1874	44.1576	44.5214	45.2491 (39)
Average = Sum(39)m / 12 =												43.9252
HLP	0.9026	0.8930	0.8881	0.8712	0.8712	0.8542	0.8518	0.8494	0.8615	0.8809	0.8881	0.9026 (40)
HLP (average)												0.8762
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													1.6939 (42)
Hot water usage for mixer showers													52.4195 (42a)
Hot water usage for baths													22.6751 (42b)
Hot water usage for other uses													31.9775 (42c)
Average daily hot water use (litres/day)													98.6801 (43)
Daily hot water use	107.3507	105.0591	102.2682	98.0232	94.5763	90.8706	89.4457	92.2247	95.1556	99.0461	103.3565	107.0721 (44)	
Energy conte	170.0172	149.6028	157.1823	134.1888	127.3179	111.7359	108.1768	114.1934	117.3363	134.4046	147.2503	167.6491 (45)	
Energy content (annual)													Total = Sum(45)m = 1639.0556
Distribution loss (46)m = 0.15 x (45)m	25.5026	22.4404	23.5774	20.1283	19.0977	16.7604	16.2265	17.1290	17.6004	20.1607	22.0875	25.1474 (46)	
Water storage loss:													150.0000 (47)
Store volume													1.4500 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7830 (55)
Enter (49) or (54) in (55)													
Total storage loss	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (56)	
If cylinder contains dedicated solar storage	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (62)	



# Full SAP Calculation Printout



Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	86.0656	54.8465	34.3941	13.4258	4.0791	0.0000	0.0000	0.0000	0.0000	8.6958	37.1468	87.7201 (98)
Space heating efficiency (main heating system 1)	122.6922	122.6922	122.6922	122.6922	122.6922	0.0000	0.0000	0.0000	0.0000	122.6922	122.6922	122.6922 (210)
Space heating fuel (main heating system)	70.1476	44.7025	28.0328	10.9427	3.3247	0.0000	0.0000	0.0000	0.0000	7.0875	30.2764	71.4960 (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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (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	13.2013	11.9237	13.2013	12.7754	13.2013	12.7754	13.2013	13.2013	12.7754	13.2013	12.7754	13.2013 (231)
Lighting	15.0184	12.0483	10.8482	7.9478	6.1391	5.0157	5.6003	7.2795	9.4554	12.4060	14.0125	15.4358 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.1967	-62.7994	-98.7926	-118.6467	-128.3787	-125.2349	-117.9397	-114.0238	-97.8146	-76.2509	-50.1600	-37.9638 (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)	-20.6130	-40.6269	-97.0031	-175.5993	-235.5194	-271.4954	-232.0849	-204.0671	-136.3530	-68.4168	-27.8670	-14.8319 (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												266.0102 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000
Water heating fuel used												2198.7466 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1050)												155.4346 (230a)
mechanical ventilation fans (SFP = 1.1050)												155.4346 (231)
Total electricity for the above, kWh/year												121.2071 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2598.6798 (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												142.7186 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	266.0102	25.1600	66.9282 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2198.7466	25.1600	553.2046 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	155.4346	25.1600	39.1073 (249)
Energy for lighting	121.2071	25.1600	30.4957 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1074.2018	25.1600	-270.2692
PV Unit electricity exported	-1524.4780	5.8100	-88.5722
Total			-358.8413 (252)
Total energy cost			330.8945 (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	266.0102	0.1581	42.0686 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2198.7466	0.1408	309.6904 (264)
Space and water heating			351.7590 (265)
Pumps, fans and electric keep-hot	155.4346	0.1387	21.5607 (267)
Energy for lighting	121.2071	0.1443	17.4939 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1074.2018	0.1336	-143.5616
PV Unit electricity exported	-1524.4780	0.1228	-187.1638
Total			-330.7255 (269)
Total CO2, kg/year			60.0882 (272)

# Full SAP Calculation Printout



## 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	266.0102	1.5854	421.7389 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2198.7466	1.5208	3343.8640 (278)
Space and water heating			3765.6029 (279)
Pumps, fans and electric keep-hot	155.4346	1.5128	235.1414 (281)
Energy for lighting	121.2071	1.5338	185.9115 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1074.2018	1.4939	-1604.7140
PV Unit electricity exported	-1524.4780	0.4506	-686.8629
Total			-2291.5769 (283)
Total Primary energy kWh/year			1895.0789 (286)

## SAP 10 EPC IMPROVEMENTS

### ASHP & Solar

Current energy efficiency rating: B 84  
 Current environmental impact rating: A 98

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

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

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

Potential energy efficiency rating: B 84  
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)  
 Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£690	£690	£0
Space heating	£106	£106	£0
Water heating	£553	£553	£0
Lighting	£30	£30	£0
Generated (PV)	-£359	-£359	£0
Total cost of fuels	£331	£331	£0
Total cost of uses	£330	£330	£0
Delivered energy	3 kWh/m <sup>2</sup>	3 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.1 tonnes	0.1 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	38 kWh/m <sup>2</sup>	38 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

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

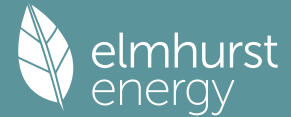
### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	50.1300 (1b)	x 2.3000 (2b)	= 115.2990 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 115.2990 (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)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes

# Full SAP Calculation Printout



Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(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) =													80.1000 (23c)
Effective ac	0.2621	0.2589	0.2557	0.2397	0.2366	0.2206	0.2206	0.2174	0.2270	0.2366	0.2429	0.2493	(25)

### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.4500	1.1450	13.1107			(27)					
Ground Floor			50.1300	0.1500	7.5195	110.0000	5514.3000	(28a)					
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330	60.0000	2811.0000	(29a)					
Flat Roof	4.4600		4.4600	0.1500	0.6690	9.0000	40.1400	(30)					
Total net area of external elements Aum (A, m2)			112.8900					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.7322		(33)					
Party Ceiling 1			50.1300			0.0000	0.0000	(32b)					
Internal Wall 1			44.0000			9.0000	396.0000	(32c)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	8761.4400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								174.7744 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				5.4500	0.0880		0.4796						
E3 Sill				0.0000	0.0470		0.0000						
E4 Jamb				12.6000	0.0400		0.5040						
E5 Ground floor (normal)				25.3500	0.0330		0.8366						
E14 Flat roof				7.2300	0.0490		0.3543						
E16 Corner (normal)				9.2000	0.0350		0.3220						
E17 Corner (inverted - internal area greater than external area)				2.3000	0.0350		0.0805						
E7 Party floor between dwellings (in blocks of flats)				25.3500	0.0310		0.7859						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								3.3628 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	33.0950 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	9.9711	9.8498	9.7286	9.1222	9.0009	8.3945	8.3945	8.2732	8.6370	9.0009	9.2434	9.4860	(38)
Heat transfer coeff	43.0661	42.9448	42.8235	42.2171	42.0958	41.4894	41.4894	41.3682	41.7320	42.0958	42.3384	42.5810	(39)
Average = Sum(39)m / 12 =												42.1868	
HLP	0.8591	0.8567	0.8542	0.8422	0.8397	0.8276	0.8276	0.8252	0.8325	0.8397	0.8446	0.8494	(40)
HLP (average)												0.8415	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy													1.6939	(42)
Hot water usage for mixer showers	52.6211	51.8303	50.6780	48.4732	46.8461	45.0316	44.0002	45.1438	46.3975	48.3457	50.5978	52.4195	52.4195	(42a)
Hot water usage for baths	22.7520	22.4141	21.9383	21.0609	20.4040	19.6755	19.2821	19.7546	20.2690	21.0485	21.9439	22.6751	22.6751	(42b)
Hot water usage for other uses	31.9775	30.8147	29.6519	28.4891	27.3262	26.1634	26.1634	27.3262	28.4891	29.6519	30.8147	31.9775	31.9775	(42c)
Average daily hot water use (litres/day)													98.6801	(43)
Daily hot water use	107.3507	105.0591	102.2682	98.0232	94.5763	90.8706	89.4457	92.2247	95.1556	99.0461	103.3565	107.0721	107.0721	(44)
Energy conte	170.0172	149.6028	157.1823	134.1888	127.3179	111.7359	108.1768	114.1934	117.3363	134.4046	147.2503	167.6491	167.6491	(45)
Energy content (annual)										Total = Sum(45)m =		1639.0556		
Distribution loss (46)m = 0.15 x (45)m	25.5026	22.4404	23.5774	20.1283	19.0977	16.7604	16.2265	17.1290	17.6004	20.1607	22.0875	25.1474	25.1474	(46)
Water storage loss:														
Store volume													150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4500	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.7830	(55)
Total storage loss	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	(56)
If cylinder contains dedicated solar storage	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845	215.1845	(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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845	215.1845	(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														

# Full SAP Calculation Printout



94.5590 84.0911 90.2914 81.4194 80.3615 73.9538 73.9971 75.9976 75.8159 82.7179 85.7623 93.7716 (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	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1581	15.2397	12.3937	9.3829	7.0138	5.9213	6.3982	8.3167	11.1626	14.1735	16.5425	17.6350 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.2561	222.5417	216.7821	204.5207	189.0428	174.4958	164.7776	162.4920	168.2515	180.5130	195.9908	210.5378 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575 (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)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)	127.0955	125.1356	121.3595	113.0825	108.0128	102.7136	99.4585	102.1473	105.2999	111.1799	119.1143	126.0371 (72)
Total internal gains	445.2458	443.6530	431.2714	407.7221	384.8055	363.8669	351.3704	353.6921	365.4501	386.6024	412.3837	434.9460 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.6700	10.6334	0.7600	0.7000	0.7700	22.2280 (74)						
South	5.7800	46.7521	0.7600	0.7000	0.7700	99.6262 (78)						
Solar gains	121.8542	205.6408	280.0213	350.8463	400.9694	402.7724	386.2711	347.3728	303.8988	226.5510	145.5121	104.6165 (83)
Total gains	567.0999	649.2938	711.2927	758.5684	785.7749	766.6393	737.6414	701.0649	669.3489	613.1534	557.8958	539.5625 (84)

## 7. Mean internal temperature (heating season)

### Temperature during heating periods in the living area from Table 9, Th<sub>l</sub> (C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil <sub>m</sub> (see Table 9a)												
tau	56.5116	56.6712	56.8317	57.6480	57.8141	58.6591	58.6591	58.8311	58.3181	57.8141	57.4829	57.1554
alpha	4.7674	4.7781	4.7888	4.8432	4.8543	4.9106	4.9106	4.9221	4.8879	4.8543	4.8322	4.8104
util living area	0.9087	0.8519	0.7667	0.6374	0.4896	0.3451	0.2473	0.2711	0.4262	0.6678	0.8499	0.9215 (86)
Living	20.4739	20.6222	20.7642	20.8741	20.9208	20.9348	20.9366	20.9366	20.9306	20.8718	20.6763	20.4410
Non living	19.6038	19.7814	19.9466	20.0760	20.1244	20.1471	20.1484	20.1506	20.1398	20.0785	19.8585	19.5715
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.2024	20.2045	20.2066	20.2169	20.2190	20.2294	20.2294	20.2315	20.2253	20.2190	20.2149	20.2107 (88)
util rest of house	0.8945	0.8319	0.7396	0.6032	0.4508	0.3040	0.2041	0.2260	0.3798	0.6276	0.8266	0.9089 (89)
MIT 2	20.2024	20.2045	20.2066	20.2169	20.2190	20.2294	20.2294	20.2315	20.2253	20.2190	20.2149	20.2107 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	20.6455	20.6464	20.6474	20.6520	20.6529	20.6575	20.6575	20.6585	20.6557	20.6529	20.6511	20.6492 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6455	20.6464	20.6474	20.6520	20.6529	20.6575	20.6575	20.6585	20.6557	20.6529	20.6511	20.6492 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9027	0.8433	0.7550	0.6225	0.4725	0.3269	0.2281	0.2511	0.4057	0.6503	0.8399	0.9161 (94)
Useful gains	511.8943	547.5473	536.9958	472.1736	371.2635	250.6159	168.2529	176.0174	271.5311	398.7215	468.5885	494.3046 (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	703.9375	676.2278	605.8399	496.1347	376.8800	251.3236	168.3447	176.1646	273.5816	423.1854	573.7300	700.4231 (97)
Space heating kWh	142.8801	86.4733	51.2200	17.2520	4.1787	0.0000	0.0000	0.0000	0.0000	18.2012	75.7019	153.3521 (98a)
Space heating requirement - total per year (kWh/year)												549.2593
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	142.8801	86.4733	51.2200	17.2520	4.1787	0.0000	0.0000	0.0000	0.0000	18.2012	75.7019	153.3521 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												549.2593
Space heating per m <sup>2</sup>										(98c) / (4) =		10.9567 (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 %)												115.3374 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	142.8801	86.4733	51.2200	17.2520	4.1787	0.0000	0.0000	0.0000	0.0000	18.2012	75.7019	153.3521 (98)
Space heating efficiency (main heating system 1)	115.3374	115.3374	115.3374	115.3374	115.3374	0.0000	0.0000	0.0000	0.0000	115.3374	115.3374	115.3374 (210)
Space heating fuel (main heating system)	123.8802	74.9742	44.4089	14.9579	3.6230	0.0000	0.0000	0.0000	0.0000	15.7808	65.6352	132.9596 (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)



# Full SAP Calculation Printout



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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845	(217)
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	13.2013	11.9237	13.2013	12.7754	13.2013	12.7754	13.2013	13.2013	12.7754	13.2013	12.7754	13.2013	(231)
Lighting	15.0184	12.0483	10.8482	7.9478	6.1391	5.0157	5.6003	7.2795	9.4554	12.4060	14.0125	15.4358	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-35.4054	-55.8571	-89.5613	-107.9127	-121.1796	-114.6166	-112.7266	-104.0922	-86.8837	-65.9211	-40.2344	-29.7051	(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	-12.1044	-30.8988	-76.4035	-138.2248	-201.5031	-209.7686	-204.3917	-160.9465	-103.7771	-50.0935	-17.6332	-9.0091	(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													476.2197 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													100.0000
Water heating fuel used													2198.7466 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1050)													
mechanical ventilation fans (SFP = 1.1050)													155.4346 (230a)
Total electricity for the above, kWh/year													155.4346 (231)
Electricity for lighting (calculated in Appendix L)													121.2071 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2178.8502 (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													772.7578 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	476.2197	16.4900	78.5286 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2198.7466	16.4900	362.5733 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	155.4346	16.4900	25.6312 (249)
Energy for lighting	121.2071	16.4900	19.9870 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-964.0959	16.4900	-158.9794
PV Unit electricity exported	-1214.7543	5.5900	-67.9048
Total			-226.8842 (252)
Total energy cost			259.8360 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.9833 (257)
SAP value			84.0608
SAP rating (Section 12)			84 (258)
SAP band			B

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	476.2197	0.1582	75.3296 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2198.7466	0.1408	309.6904 (264)
Space and water heating			385.0200 (265)
Pumps, fans and electric keep-hot	155.4346	0.1387	21.5607 (267)
Energy for lighting	121.2071	0.1443	17.4939 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-964.0959	0.1330	-128.2457
PV Unit electricity exported	-1214.7543	0.1217	-147.8469
Total			-276.0926 (269)
Total CO2, kg/year			147.9821 (272)
CO2 emissions per m2			2.9500 (273)
EI value			97.9155
EI rating			98 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	50.1300 (1b)	2.3000 (2b)	115.2990 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1300		115.2990 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 115.2990 (5)

## 2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure Test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.9000	6.5000	6.3000	5.6000	5.6000	4.9000	4.8000	4.7000	5.2000	6.0000	6.3000	6.9000 (22)
Wind factor	1.7250	1.6250	1.5750	1.4000	1.4000	1.2250	1.2000	1.1750	1.3000	1.5000	1.5750	1.7250 (22a)
Adj infilt rate	0.2199	0.2072	0.2008	0.1785	0.1785	0.1562	0.1530	0.1498	0.1658	0.1913	0.2008	0.2199 (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)												80.1000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3194	0.3067	0.3003	0.2780	0.2780	0.2557	0.2525	0.2493	0.2652	0.2907	0.3003	0.3194 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			11.4500	1.1450	13.1107		(27)					
Ground Floor			50.1300	0.1500	7.5195	110.0000	5514.3000 (28a)					
External Wall	58.3000	11.4500	46.8500	0.1800	8.4330	60.0000	2811.0000 (29a)					
Flat Roof	4.4600		4.4600	0.1500	0.6690	9.0000	40.1400 (30)					
Total net area of external elements Aum(A, m2)			112.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)					29.7322		(32)					
Party Ceiling 1			50.1300			0.0000	0.0000 (32b)					
Internal Wall 1			44.0000			9.0000	396.0000 (32c)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8761.4400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							174.7744 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				5.4500	0.0880	0.4796						
E3 Sill				0.0000	0.0470	0.0000						
E4 Jamb				12.6000	0.0400	0.5040						
E5 Ground floor (normal)				25.3500	0.0330	0.8366						
E14 Flat roof				7.2300	0.0490	0.3543						
E16 Corner (normal)				9.2000	0.0350	0.3220						
E17 Corner (inverted - internal area greater than external area)				2.3000	0.0350	0.0805						
E7 Party floor between dwellings (in blocks of flats)				25.3500	0.0310	0.7859						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3628 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 33.0950 (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	12.1542	11.6691	11.4265	10.5775	10.5775	9.7286	9.6073	9.4860	10.0924	11.0627	11.4265	12.1542 (38)
Average = Sum(39)m / 12 =	45.2491	44.7640	44.5214	43.6725	43.6725	42.8235	42.7022	42.5810	43.1874	44.1576	44.5214	45.2491 (39)
HLP	0.9026	0.8930	0.8881	0.8712	0.8712	0.8542	0.8518	0.8494	0.8615	0.8809	0.8881	0.9026 (40)
HLP (average)												0.8762
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

# Full SAP Calculation Printout



4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.6939 (42)
Hot water usage for mixer showers												52.4195 (42a)
Hot water usage for baths												22.6751 (42b)
Hot water usage for other uses												31.9775 (42c)
Average daily hot water use (litres/day)												98.6801 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3507	105.0591	102.2682	98.0232	94.5763	90.8706	89.4457	92.2247	95.1556	99.0461	103.3565	107.0721 (44)
Energy content (annual)	170.0172	149.6028	157.1823	134.1888	127.3179	111.7359	108.1768	114.1934	117.3363	134.4046	147.2503	167.6491 (45)
Distribution loss (46)m = 0.15 x (45)m												25.5026
Water storage loss:												150.0000 (47)
Store volume												1.4500 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7830 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (56)
If cylinder contains dedicated solar storage	24.2730	21.9240	24.2730	23.4900	24.2730	23.4900	24.2730	24.2730	23.4900	24.2730	23.4900	24.2730 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	94.5590	84.0911	90.2914	81.4194	80.3615	73.9538	73.9971	75.9976	75.8159	82.7179	85.7623	93.7716 (65)
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357	101.6357 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1581	15.2397	12.3937	9.3829	7.0138	5.9213	6.3982	8.3167	11.1626	14.1735	16.5425	17.6350 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.2561	222.5417	216.7821	204.5207	189.0428	174.4958	164.7776	162.4920	168.2515	180.5130	195.9908	210.5378 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575	46.8575 (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)	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572	-67.7572 (71)
Water heating gains (Table 5)	127.0955	125.1356	121.3595	113.0825	108.0128	102.7136	99.4585	102.1473	105.2999	111.1799	119.1143	126.0371 (72)
Total internal gains	445.2458	443.6530	431.2714	407.7221	384.8055	363.8669	351.3704	353.6921	365.4501	386.6024	412.3837	434.9460 (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			5.6700	14.5421	0.7600	0.7000	0.7700	30.3987 (74)				
South			5.7800	60.3000	0.7600	0.7000	0.7700	128.4960 (78)				
Solar gains	158.8947	227.6100	309.8745	401.4202	440.3003	483.1225	416.8743	402.0734	352.6804	262.9731	181.9163	132.3552 (83)
Total gains	604.1405	671.2630	741.1459	809.1423	825.1058	846.9894	768.2447	755.7655	718.1305	649.5755	594.3000	567.3013 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	53.7852	54.3681	54.6643	55.7269	56.8317	56.9931	57.1554	56.3529	55.1147	54.6643	53.7852	
alpha	4.5857	4.6245	4.6443	4.7151	4.7151	4.7888	4.7995	4.8104	4.7569	4.6743	4.6443	4.5857
util living area	0.8399	0.7864	0.7050	0.5941	0.4736	0.3325	0.2720	0.2645	0.3707	0.5696	0.7482	0.8499 (86)
Living	20.6505	20.7317	20.8170	20.8859	20.9193	20.9331	20.9348	20.9351	20.9314	20.9019	20.8022	20.6447
Non living	19.7824	19.8807	19.9776	20.0631	20.0956	20.1222	20.1255	20.1279	20.1147	20.0728	19.9662	19.7773
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.1653	20.1735	20.1776	20.1921	20.1921	20.2066	20.2086	20.2107	20.2003	20.1838	20.1776	20.1653 (88)
util rest of house	0.8152	0.7580	0.6719	0.5580	0.4338	0.2930	0.2282	0.2202	0.3237	0.5221	0.7113	0.8251 (89)
MIT 2	20.1653	20.1735	20.1776	20.1921	20.1921	20.2066	20.2086	20.2107	20.2003	20.1838	20.1776	20.1653 (90)
Living area fraction												fLA = Living area / (4) =
MIT	20.6290	20.6327	20.6345	20.6409	20.6409	20.6474	20.6483	20.6492	20.6446	20.6372	20.6345	20.6290 (92)
Temperature adjustment												0.0000

# Full SAP Calculation Printout



adjusted MIT 20.6290 20.6327 20.6345 20.6409 20.6409 20.6474 20.6483 20.6492 20.6446 20.6372 20.6345 20.6290 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8293	0.7742	0.6906	0.5783	0.4560	0.3150	0.2526	0.2448	0.3499	0.5488	0.7323	0.8394	(94)
Useful gains	501.0210	519.6830	511.8251	467.9046	376.2549	266.7990	194.0244	185.0321	251.2776	356.4648	435.2267	476.1727	(95)
Ext temp.	7.0000	7.2000	8.1000	9.5000	11.9000	14.4000	16.1000	16.3000	14.8000	12.3000	9.7000	7.5000	(96)
Heat loss rate W													
Space heating	616.7006	601.2998	558.0538	486.5515	381.7376	267.5340	194.2219	185.1934	252.4127	368.1527	486.8195	594.0760	(97)
Space heating kWh	86.0656	54.8465	34.3941	13.4258	4.0791	0.0000	0.0000	0.0000	0.0000	8.6958	37.1468	87.7201	(98a)
Space heating requirement - total per year (kWh/year)													326.3738
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	86.0656	54.8465	34.3941	13.4258	4.0791	0.0000	0.0000	0.0000	0.0000	8.6958	37.1468	87.7201	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													326.3738
Space heating per m2										(98c) / (4) =			6.5105 (99)

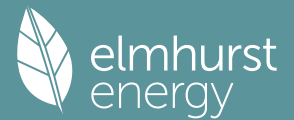
## 9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)													122.6922 (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	86.0656	54.8465	34.3941	13.4258	4.0791	0.0000	0.0000	0.0000	0.0000	8.6958	37.1468	87.7201	(98)
Space heating efficiency (main heating system 1)	122.6922	122.6922	122.6922	122.6922	122.6922	0.0000	0.0000	0.0000	0.0000	122.6922	122.6922	122.6922	(210)
Space heating fuel (main heating system)	70.1476	44.7025	28.0328	10.9427	3.3247	0.0000	0.0000	0.0000	0.0000	7.0875	30.2764	71.4960	(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	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	217.5526	192.5380	204.7177	180.1908	174.8533	157.7379	155.7122	161.7288	163.3383	181.9400	193.2523	215.1845	(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	13.2013	11.9237	13.2013	12.7754	13.2013	12.7754	13.2013	13.2013	12.7754	13.2013	12.7754	13.2013	(231)
Lighting	15.0184	12.0483	10.8482	7.9478	6.1391	5.0157	5.6003	7.2795	9.4554	12.4060	14.0125	15.4358	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-46.1967	-62.7994	-98.7926	-118.6467	-128.3787	-125.2349	-117.9397	-114.0238	-97.8146	-76.2509	-50.1600	-37.9638	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-20.6130	-40.6269	-97.0031	-175.5993	-235.5194	-271.4954	-232.0849	-204.0671	-136.3530	-68.4168	-27.8670	-14.8319	(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													266.0102 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													100.0000
Water heating fuel used													2198.7466 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1050)													
mechanical ventilation fans (SFP = 1.1050)													155.4346 (230a)
Total electricity for the above, kWh/year													155.4346 (231)
Electricity for lighting (calculated in Appendix L)													121.2071 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2598.6798 (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													142.7186 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	266.0102	25.1600	66.9282	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2198.7466	25.1600	553.2046	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)

# Full SAP Calculation Printout



Pumps, fans and electric keep-hot	155.4346	25.1600	39.1073 (249)
Energy for lighting	121.2071	25.1600	30.4957 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1074.2018	25.1600	-270.2692
PV Unit electricity exported	-1524.4780	5.8100	-88.5722
Total			-358.8413 (252)
Total energy cost			330.8945 (255)

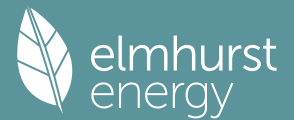
-----  
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
 -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	266.0102	0.1581	42.0686 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2198.7466	0.1408	309.6904 (264)
Space and water heating			351.7590 (265)
Pumps, fans and electric keep-hot	155.4346	0.1387	21.5607 (267)
Energy for lighting	121.2071	0.1443	17.4939 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1074.2018	0.1336	-143.5616
PV Unit electricity exported	-1524.4780	0.1228	-187.1638
Total			-330.7255 (269)
Total CO2, kg/year			60.0882 (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	266.0102	1.5854	421.7389 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2198.7466	1.5208	3343.8640 (278)
Space and water heating			3765.6029 (279)
Pumps, fans and electric keep-hot	155.4346	1.5128	235.1414 (281)
Energy for lighting	121.2071	1.5338	185.9115 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1074.2018	1.4939	-1604.7140
PV Unit electricity exported	-1524.4780	0.4506	-686.8629
Total			-2291.5769 (283)
Total Primary energy kWh/year			1895.0789 (286)

# Predicted Energy Assessment

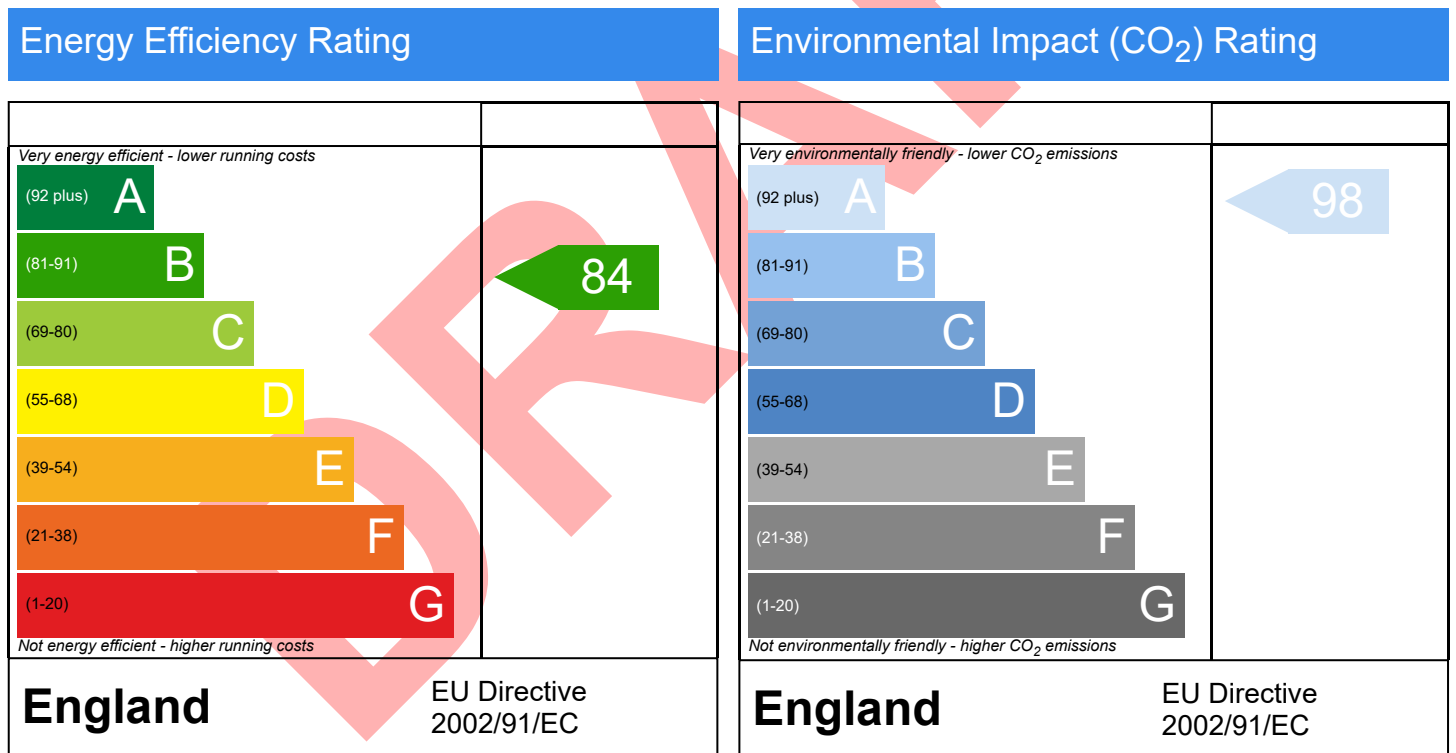


Ground Flat, 3 Avenue Road , , TR114A2

Dwelling type: Flat, Detached  
 Date of assessment: 30/03/2024  
 Produced by: Mark Scotson  
 Total floor area: 50.13 m<sup>2</sup>  
 DRRN:

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Summary for Input Data



Property Reference	Ground Flat, 3 Avenue Road		Issued on Date	30/03/2024
Assessment Reference	ASHP & Solar	Prop Type Ref	1	
Property	Ground Flat, 3 Avenue Road , , TR114A2			

SAP Rating	84 B	DER	3.19	TER	13.85
Environmental	98 A	% DER < TER			76.97
CO <sub>2</sub> Emissions (t/year)	0.06	DFEE	30.56	TFEE	36.84
Compliance Check	See BREL	% DFEE < TFEE			17.06
% DPER < TPER	27.11	DPER	53.02	TPER	72.74

Assessor Details	Mr. Mark Scotson	Assessor ID	AX66-0001
Client	Client , Client		

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	Flat, Detached
Position of Flat	Ground-floor flat
Which Floor	1
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground floor:	25.35 m	50.13 m <sup>2</sup>	2.30 m

8.0 Living Area	27.85	m <sup>2</sup>
-----------------	-------	----------------

Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area(m <sup>2</sup> )	Nett Area (m <sup>2</sup> )	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.18	60.00	58.30	46.85	0.00	None	11.45	Enter Gross Area

Description	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Internal Wall 1	Plasterboard on timber frame	9.00	44.00

Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area(m <sup>2</sup> )	Nett Area (m <sup>2</sup> )	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	4.46	4.46	None	0.00	Enter Gross Area	0.00

Description	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Party Ceiling 1	Other	0.00	50.13

Description	Type	Storey Index	Construction	U-Value (W/m <sup>2</sup> K)	Shelter Code	Shelter Factor	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Ground Floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.15	None	0.00	110.00	50.13

## 12.0 Opening Types

# Summary for Input Data



Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m <sup>2</sup> K)
Window	Manufacturer	Window	Double glazed			0.76		0.70	1.20
Opening	Manufacturer	Window	Double glazed			0.76		0.70	1.20
Roof Window	Manufacturer	Roof Light	Double glazed			0.76		0.70	1.20

## 13.0 Openings

Name	Opening Type	Location	Orientation	Area (m <sup>2</sup> )	Pitch
W	Window	External Wall	South	5.78	
W	Window	External Wall	North	5.67	

## 14.0 Conservatory

## 15.0 Draught Proofing

 %

## 16.0 Draught Lobby

## 17.0 Thermal Bridging

### 17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	5.45	0.09	0.09	No
E3 Sill	Independently assessed	0.00	0.05	0.05	No
E4 Jamb	Independently assessed	12.60	0.04	0.04	No
E5 Ground floor (normal)	Independently assessed	25.35	0.03	0.03	No
E14 Flat roof	Independently assessed	7.23	0.05	0.05	No
E16 Corner (normal)	Independently assessed	9.20	0.04	0.04	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.30	0.04	0.04	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	25.35	0.03	0.03	No

Y-value  W/m<sup>2</sup>K

## 18.0 Pressure Testing

Designed AP<sub>50</sub>  m<sup>2</sup>/(h.m<sup>2</sup>) @ 50 Pa

Test Method

## 19.0 Mechanical Ventilation

### Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="No"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Balanced mechanical ventilation with heat recovery"/>
MV Reference Number	<input type="text" value="500793"/>
Configuration	<input type="text" value="2"/>
Manufacturer SFP	<input type="text" value="0.65"/>
Duct Type	<input type="text" value="Flexible"/>
MVHR Efficiency	<input type="text" value="89.00"/>
Wet Rooms	<input type="text" value="2"/>
SFP from Installer Commissioning Certificate	<input type="text" value="No"/>
MVHR System Location	<input type="text" value="Inside heated envelope (installed exclusively)"/>
Duct Installation Specification	<input type="text" value="Level 1"/>

## 20.0 Fans, Open Fireplaces, Flues

### 21.0 Fixed Cooling System

### 22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	5	500	10

### 24.0 Main Heating 1

Description

Percentage of Heat  %

Database Ref. No.

Fuel Type

In Winter



# Summary for Input Data



In Summer	100.00
Model Name	ECODAN
Manufacturer	Mitsubishi Electric Europe B.V.
System Type	Heat Pump
Controls SAP Code	2207
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Enter value
Flow Temperature Value	35.00

**25.0 Main Heating 2**

**26.0 Heat Networks**

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1									
Heat source 2									
Heat source 3									
Heat source 4									
Heat source 5									

**28.0 Water Heating**

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1

**28.1 Showers**

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

**28.3 Waste Water Heat Recovery System**

**29.0 Hot Water Cylinder**

Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	150.00	L
Loss	1.45	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

**31.0 Thermal Store**

**32.0 Photovoltaic Unit**

One Dwelling	One Dwelling
Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	No

# Summary for Input Data



Battery Capacity [kWh]	<input type="text" value="0.00"/>										
<b>PV Cells kWp</b>	<b>Orientation</b>	<b>Elevation</b>	<b>Overshading</b>	<b>FGHRS</b>	<b>MCS Certificate</b>	<b>Overshading Factor</b>	<b>MCS Certificate Reference</b>	<b>Panel Manufacturer</b>			
3.00	West	30°	None Or Little		No	1.00					

<b>34.0 Small-scale Hydro</b>	<input type="text" value="None"/>										
<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>

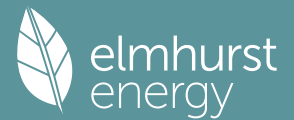
**Recommendations**

Lower cost measures  
None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
		0	0
		0	0
		0	0

# Thermal Bridging



Property Reference	Ground Flat, 3 Avenue Road		Issued on Date	30/03/2024
Assessment Reference	ASHP & Solar	Prop Type Ref	Detached Flat	
Property	Ground Flat, 3 Avenue Road , , TR114A2			

SAP Rating	84 B	DER	3.19	TER	13.85
Environmental	98 A	% DER < TER			76.97
CO <sub>2</sub> Emissions (t/year)	0.06	DFEE	30.56	TFEE	36.84
Compliance Check	See BREL	% DFEE < TFEE			17.06
% DPER < TPER	27.11	DPER	53.02	TPER	72.74

Assessor Details	Mr. Mark Scotson	Assessor ID	AX66-0001
Client	Client , Client		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.088	5.45	0.48	
External wall	E3 Sill	Independently assessed	0.047	0.00	0.00	
External wall	E4 Jamb	Independently assessed	0.040	12.60	0.50	
External wall	E5 Ground floor (normal)	Independently assessed	0.033	25.35	0.84	
External wall	E14 Flat roof	Independently assessed	0.049	7.23	0.35	
External wall	E16 Corner (normal)	Independently assessed	0.035	9.20	0.32	
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	0.035	2.30	0.08	
External wall	E7 Party floor between dwellings (in blocks of flats)	Independently assessed	0.031	25.35	0.79	

Total:  W/mK:  
 Y-Value:  W/m<sup>2</sup>K: