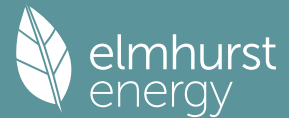


Full SAP Calculation Printout



Property Reference	P22691(1) Mount P				Issued on Date	24/02/2023	
Assessment Reference	P22691(1)			Prop Type Ref			
Property	New House 1, 40-48, Mount Pleasant, Reading, RG1 2TF						
SAP Rating	82 B		DER	4.37		TER	13.79
Environmental	96 A		% DER < TER				68.31
CO ₂ Emissions (t/year)	0.32		DFEE	44.04		TFEE	44.15
Compliance Check	See BREL		% DFEE < TFEE				0.24
% DPER < TPER	36.55		DPER	45.97		TPER	72.46
Assessor Details	Mr. Malcolm Lisle					Assessor ID	P736-0001
Client	Mount P, Jay Zaman						

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	29.5600 (1b)	x 2.5000 (2b)	= 73.9000 (1b) -
First floor	31.0800 (1c)	x 2.8000 (2c)	= 87.0240 (1c) -
Second floor	17.7600 (1d)	x 2.9000 (2d)	= 51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 212.4280 (5)

2. Ventilation rate

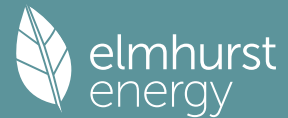
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1412 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3412 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3156 (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	0.4024	0.3945	0.3866	0.3472	0.3393	0.2999	0.2999	0.2920	0.3156	0.3393	0.3551	0.3709 (22b)
Effective ac	0.5810	0.5778	0.5747	0.5603	0.5576	0.5450	0.5450	0.5426	0.5498	0.5576	0.5630	0.5688 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			24.6900	1.1450	28.2710		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			29.5600	0.1000	2.9560	110.0000	3251.6000 (28a)
External Wall	114.8000	24.6900	90.1100	0.1500	13.5165	9.0000	810.9900 (29a)
External Roof - Sloping	23.1800	4.0600	19.1200	0.1500	2.8680	9.0000	172.0800 (30)
External Roof - Flat Roof	13.3200		13.3200	0.1500	1.9980	9.0000	119.8800 (30)

Full SAP Calculation Printout



Total net area of external elements Aum(A, m2)	180.8600			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	56.0720		(33)
Party Wall 1	54.1200	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber	105.3000		9.0000	947.7000 (32c)
Internal Floor - 1st Floor	29.5600		18.0000	532.0800 (32d)
Internal Floor - 2nd Floor	17.7600		18.0000	319.6800 (32d)
Internal Ceiling - G Floor	29.5600		9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor	17.7600		9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10368.2900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 132.2486 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	13.1000	0.0580	0.7598	
E3 Sill	8.6000	0.0450	0.3870	
E4 Jamb	47.2000	0.0500	2.3600	
E5 Ground floor (normal)	15.8000	0.0550	0.8690	
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000	
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728	
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624	
E15 Flat roof with parapet	7.0000	0.3000	2.1000	
E16 Corner (normal)	12.1000	0.0440	0.5324	
E18 Party wall between dwellings	2.5000	0.0370	0.0925	
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402	
P1 Party wall - Ground floor	7.6000	0.0490	0.3724	
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541	
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040	
R1 Head of roof window	3.1000	0.2400	0.7440	
R2 Sill of roof window	3.1000	0.2400	0.7440	
R3 Jamb of roof window	4.8000	0.2400	1.1520	
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				14.4951 (36)
Point Thermal bridges				0.0000 (36a) =
Total fabric heat loss				70.5671 (37) (33) + (36) + (36a) =

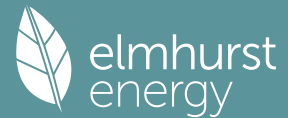
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.7271	40.5067	40.2906	39.2758	39.0859	38.2020	38.2020	38.0384	38.5425	39.0859	39.4700	39.8716	(38)
Heat transfer coeff	111.2942	111.0738	110.8578	109.8429	109.6531	108.7692	108.7692	108.6055	109.1096	109.6531	110.0372	110.4387	(39)
Average = Sum(39)m / 12 =												109.8420	
HLP	1.4196	1.4168	1.4140	1.4011	1.3986	1.3874	1.3874	1.3853	1.3917	1.3986	1.4035	1.4087	(40)
HLP (average)												1.4010	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4318 (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	78.8836	77.7121	76.0623	73.0204	70.7427	68.2171	66.8529	68.4911	70.2748	72.9773	76.0818	78.6169	(42b)
Hot water usage for other uses	41.6148	40.1016	38.5883	37.0750	35.5618	34.0485	34.0485	35.5618	37.0750	38.5883	40.1016	41.6148	(42c)
Average daily hot water use (litres/day)												110.9692	(43)
Daily hot water use	120.4984	117.8136	114.6506	110.0955	106.3045	102.2656	100.9014	104.0529	107.3499	111.5656	116.1834	120.2317	(44)
Energy conte	190.8400	167.7650	176.2137	150.7152	143.1063	125.7475	122.0315	128.8392	132.3731	151.3935	165.5245	188.2538	(45)
Energy content (annual)										Total = Sum(45)m =		1842.8033	
Distribution loss (46)m = 0.15 x (45)m	28.6260	25.1648	26.4321	22.6073	21.4659	18.8621	18.3047	19.3259	19.8560	22.7090	24.8287	28.2381	(46)
Water storage loss:												150.0000	(47)
Store volume												1.8600	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400	(49)
Temperature factor from Table 2b												1.0044	(55)
Enter (49) or (54) in (55)													
Total storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(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	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526	(62)
WVHRS	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	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2483.3053	(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)

Full SAP Calculation Printout



Heat gains from water heating, kWh/month
106.9734 95.0894 102.1101 92.2280 91.1019 83.9262 84.0945 86.3581 86.1293 93.8574 97.1521 106.1134 (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	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.9795	120.6559	108.9795	112.6122	108.9795	112.6122	108.9795	108.9795	112.6122	108.9795	112.6122	108.9795	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.0641	218.3061	212.6562	200.6281	185.4449	171.1748	161.6414	159.3994	165.0493	177.0774	192.2606	206.5308	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	(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)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	(71)
Water heating gains (Table 5)	143.7814	141.5021	137.2447	128.0944	122.4488	116.5642	113.0302	116.0727	119.6240	126.1524	134.9335	142.6256	(72)
Total internal gains	528.3020	539.9411	518.3575	500.8118	476.3502	459.8281	443.1282	443.9286	456.7625	471.6863	499.2833	517.6129	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4800	10.6334	0.6300	0.7000	0.7700	24.3078 (74)
East	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (76)
South	12.8900	46.7521	0.6300	0.7000	0.7700	184.1728 (78)
East	4.0600	26.2379	0.6300	0.7000	1.0000	42.2802 (82)

Solar gains	276.6908	483.6742	691.9489	903.5328	1051.0032	1059.6973	1014.9428	902.9929	765.2143	542.9556	333.7291	235.2550	(83)
Total gains	804.9928	1023.6153	1210.3064	1404.3446	1527.3534	1519.5254	1458.0710	1346.9215	1221.9767	1014.6419	833.0124	752.8679	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.8781	25.9294	25.9800	26.2200	26.2654	26.4788	26.4788	26.5187	26.3962	26.2654	26.1737	26.0785	
alpha	2.7252	2.7286	2.7320	2.7480	2.7510	2.7653	2.7653	2.7679	2.7597	2.7510	2.7449	2.7386	
util living area	0.9393	0.8934	0.8258	0.7127	0.5741	0.4278	0.3179	0.3556	0.5420	0.7747	0.9043	0.9480	(86)
Living	19.2170	19.5626	19.9652	20.3886	20.6707	20.8189	20.8662	20.8576	20.7506	20.3486	19.7070	19.1530	
Non living	17.7144	18.1412	18.6297	19.1292	19.4356	19.5852	19.6212	19.6182	19.5281	19.1045	18.3369	17.6406	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.0879	19.5626	19.9652	20.3886	20.6707	20.8189	20.8662	20.8576	20.7506	20.3486	19.7070	19.4114	(87)
Th 2	19.7484	19.7505	19.7526	19.7625	19.7644	19.7730	19.7730	19.7746	19.7697	19.7644	19.7606	19.7567	(88)
util rest of house	0.9285	0.8758	0.7985	0.6710	0.5168	0.3550	0.2333	0.2667	0.4648	0.7299	0.8853	0.9385	(89)
MIT 2	18.9375	18.1412	18.6297	19.1292	19.4356	19.5852	19.6212	19.6182	19.5281	19.1045	18.3369	18.0219	(90)
Living area fraction									fLA = Living area / (4) =			0.3515	(91)
MIT	19.3419	18.6409	19.0991	19.5719	19.8698	20.0188	20.0588	20.0539	19.9579	19.5418	18.8185	18.5104	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3419	18.6409	19.0991	19.5719	19.8698	20.0188	20.0588	20.0539	19.9579	19.5418	18.8185	18.5104	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9245	0.8570	0.7821	0.6640	0.5219	0.3701	0.2535	0.2875	0.4773	0.7207	0.8675	0.9267	(94)
Useful gains	744.1970	877.2801	946.5612	932.4974	797.1471	562.3415	369.5846	387.2296	583.2933	731.2850	722.6539	697.6841	(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	1674.0768	1526.2501	1396.7128	1172.2371	895.8449	589.4038	376.2153	396.8316	639.1483	980.4986	1289.4748	1580.4182	(97)
Space heating kWh	691.8306	436.1078	334.9128	172.6126	73.4312	0.0000	0.0000	0.0000	0.0000	185.4149	408.1110	656.7542	(98a)
Space heating requirement - total per year (kWh/year)												2959.1752	
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	691.8306	436.1078	334.9128	172.6126	73.4312	0.0000	0.0000	0.0000	0.0000	185.4149	408.1110	656.7542	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2959.1752	
Space heating per m2										(98c) / (4) =		37.7446	(99)

Full SAP Calculation Printout



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 %)													350.2501 (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	691.8306	436.1078	334.9128	172.6126	73.4312	0.0000	0.0000	0.0000	0.0000	185.4149	408.1110	656.7542	(98)
Space heating efficiency (main heating system 1)	350.2501	350.2501	350.2501	350.2501	350.2501	0.0000	0.0000	0.0000	0.0000	350.2501	350.2501	350.2501	(210)
Space heating fuel (main heating system)	197.5247	124.5133	95.6210	49.2827	20.9654	0.0000	0.0000	0.0000	0.0000	52.9379	116.5199	187.5101	(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	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526	(64)
Efficiency of water heater	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	(216)
Fuel for water heating, kWh/month	130.0920	115.0587	122.3331	107.8760	104.7706	94.6314	93.5911	97.2023	98.1461	109.1667	115.7320	128.7201	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	21.6424	17.3623	15.6329	11.4533	8.8469	7.2280	8.0704	10.4902	13.6258	17.8777	20.1928	22.2439	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)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	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													844.8748 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													188.5119
Water heating fuel used													1317.3202 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													174.6666 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (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													2336.8616 (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	844.8748	0.1561	131.9217	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1317.3202	0.1408	185.4958	(264)
Space and water heating			317.4175	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	174.6666	0.1443	25.2098	(268)
Total CO2, kg/year			342.6273	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3700	(273)

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

Full SAP Calculation Printout



	Energy kWh/year	Primary energy kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	844.8748	1.5780	1333.2186 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.3202	1.5207	2003.2106 (278)
Space and water heating			3336.4292 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	174.6666	1.5338	267.9094 (282)
Total Primary energy kWh/year			3604.3386 (286)
Dwelling Primary energy Rate (DPER)			45.9700 (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	29.5600 (1b)	x 2.5000 (2b)	= 73.9000 (1b) -
First floor	31.0800 (1c)	x 2.8000 (2c)	= 87.0240 (1c) -
Second floor	17.7600 (1d)	x 2.9000 (2d)	= 51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	212.4280 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) =	0.1412 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3912	(18)
Number of sides sheltered	1	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3619 (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	0.4614	0.4524	0.4433	0.3981	0.3890	0.3438	0.3438	0.3347	0.3619	0.3890	0.4071	0.4252 (22b)
Effective ac	0.6064	0.6023	0.5983	0.5792	0.5757	0.5591	0.5591	0.5560	0.5655	0.5757	0.5829	0.5904 (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)			16.8400	1.1450	19.2824		(27)
Rooflights			2.7700	1.5038	4.1654		(27a)
Ground Floor			29.5600	0.1300	3.8428		(28a)
External Wall	114.8000	16.8400	97.9600	0.1800	17.6328		(29a)
External Roof - Sloping	23.1800	2.7700	20.4100	0.1100	2.2451		(30)
External Roof - Flat Roof	13.3200		13.3200	0.1100	1.4652		(30)
Total net area of external elements Aum(A, m2)			180.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.6338		(33)
Party Wall 1			54.1200	0.0000	0.0000		(32)

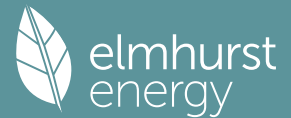
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	132.2486 (35)
---	---------------

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.1000	0.0500	0.6550

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 121.5901	Feb 121.5901	Mar 121.5901	Apr 121.5901	May 121.5901	Jun 121.5901	Jul 121.5901	Aug 121.5901	Sep 121.5901	Oct 121.5901	Nov 121.5901	Dec 121.5901 (66)
Lighting gains	(calculated in Appendix L, equation L9 or L9a), also see Table 5											
	108.9795	120.6559	108.9795	112.6122	108.9795	112.6122	108.9795	108.9795	112.6122	108.9795	112.6122	108.9795 (67)
Appliances gains	(calculated in Appendix L, equation L13 or L13a), also see Table 5											

Full SAP Calculation Printout



Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	216.0641	218.3061	212.6562	200.6281	185.4449	171.1748	161.6414	159.3994	165.0493	177.0774	192.2606	206.5308 (68)
Pumps, fans	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720 (71)
Total internal gains	131.1257	128.9603	124.9159	116.2231	110.8597	105.2694	101.9121	104.8024	108.1761	114.3781	122.7202	130.0277 (72)
	518.6463	530.3994	509.0286	491.9404	467.7611	448.5333	432.0101	432.6583	445.3146	462.9120	490.0700	508.0150 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.1000	10.6334	0.6300	0.7000	0.7700	16.5735 (74)
East	2.9500	19.6403	0.6300	0.7000	0.7700	17.7068 (76)
South	8.7900	46.7521	0.6300	0.7000	0.7700	125.5919 (78)
East	2.7700	26.2379	0.6300	0.7000	1.0000	28.8463 (82)

Solar gains	188.7185	329.9011	471.9770	616.3181	716.9228	722.8570	692.3269	615.9549	521.9586	370.3405	227.6235	160.4559 (83)
Total gains	707.3648	860.3005	981.0056	1108.2585	1184.6839	1171.3903	1124.3370	1048.6132	967.2733	833.2525	717.6935	668.4708 (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	27.0483	27.1221	27.1948	27.5417	27.6076	27.9186	27.9186	27.9769	27.7980	27.6076	27.4746	27.3370
alpha	2.8032	2.8081	2.8130	2.8361	2.8405	2.8612	2.8612	2.8651	2.8532	2.8405	2.8316	2.8225
util living area	0.9531	0.9221	0.8750	0.7861	0.6620	0.5101	0.3852	0.4250	0.6208	0.8280	0.9268	0.9592 (86)
MIT	18.7320	19.1155	19.6058	20.1850	20.6151	20.8697	20.9567	20.9419	20.7626	20.1823	19.3637	18.6719 (87)
Th 2	19.7956	19.7984	19.8012	19.8144	19.8169	19.8285	19.8285	19.8306	19.8240	19.8169	19.8119	19.8067 (88)
util rest of house	0.9446	0.9086	0.8534	0.7501	0.6064	0.4320	0.2897	0.3268	0.5439	0.7900	0.9118	0.9517 (89)
MIT 2	17.2075	17.6863	18.2917	18.9916	19.4758	19.7396	19.8091	19.8025	19.6456	19.0114	18.0137	17.1388 (90)
Living area fraction									fLA = Living area / (4) =			0.3515 (91)
MIT	17.7434	18.1887	18.7536	19.4111	19.8763	20.1369	20.2125	20.2031	20.0383	19.4230	18.4883	17.6777 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7434	18.1887	18.7536	19.4111	19.8763	20.1369	20.2125	20.2031	20.0383	19.4230	18.4883	17.6777 (93)

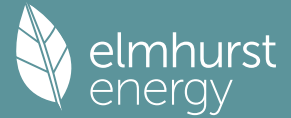
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9247	0.8853	0.8306	0.7363	0.6094	0.4535	0.3219	0.3591	0.5589	0.7752	0.8899	0.9331 (94)
Useful gains	654.1145	761.6398	814.8510	815.9740	721.9188	531.1999	361.9392	376.5925	540.6164	645.9476	638.6966	623.7672 (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	1431.4447	1411.1205	1297.7275	1099.1665	852.9694	571.1844	372.6647	391.5061	615.2500	920.4347	1193.7989	1419.9423 (97)
Space heating kWh	578.3337	436.4510	359.2601	203.8986	97.5016	0.0000	0.0000	0.0000	0.0000	204.2184	399.6736	592.3543 (98a)
Space heating requirement - total per year (kWh/year)												2871.6914
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	578.3337	436.4510	359.2601	203.8986	97.5016	0.0000	0.0000	0.0000	0.0000	204.2184	399.6736	592.3543 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2871.6914
Space heating per m2										(98c) / (4) =		36.6287 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	578.3337	436.4510	359.2601	203.8986	97.5016	0.0000	0.0000	0.0000	0.0000	204.2184	399.6736	592.3543 (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)	626.5804	472.8613	389.2309	220.9086	105.6356	0.0000	0.0000	0.0000	0.0000	221.2550	433.0159	641.7706 (211)
Space heating efficiency (main heating system 2)												

Full SAP Calculation Printout



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 (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	227.8929	201.4625	213.9979	188.2713	182.5458	164.5519	162.5248	168.9921	170.8463	190.4187	202.3402	225.4361 (64)
Efficiency of water heater	86.0565	85.7459	85.2124	84.2390	82.7189	79.8000	79.8000	79.8000	79.8000	84.2170	85.5568	79.8000 (216)
Fuel for water heating, kWh/month	264.8177	234.9530	251.1346	223.4966	220.6822	206.2054	203.6652	211.7696	214.0931	226.1049	236.4980	261.7622 (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	22.6438	18.1657	16.3562	11.9832	9.2562	7.5624	8.4438	10.9756	14.2562	18.7049	21.1272	23.2731 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-29.2919	-42.1745	-61.9000	-71.1161	-77.9866	-73.2590	-72.3497	-67.6551	-59.5939	-48.8966	-32.5103	-25.2222 (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	-13.9897	-29.6872	-59.4849	-90.0459	-119.7504	-120.5758	-119.1663	-100.5940	-73.3252	-42.7003	-18.7572	-11.0443 (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												3111.2582 (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												2755.1825 (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)												182.7484 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1461.0771 (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												4674.1120 (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	3111.2582	0.2100	653.3642 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2755.1825	0.2100	578.5883 (264)
Space and water heating			1231.9526 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	182.7484	0.1443	26.3762 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-661.9558	0.1341	-88.7970
PV Unit electricity exported	-799.1212	0.1257	-100.4209
Total			-189.2179 (269)
Total CO2, kg/year			1081.0402 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7900 (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	3111.2582	1.1300	3515.7218 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2755.1825	1.1300	3113.3562 (278)
Space and water heating			6629.0780 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	182.7484	1.5338	280.3055 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-661.9558	1.4957	-990.1179
PV Unit electricity exported	-799.1212	0.4613	-368.6051
Total			-1358.7230 (283)
Total Primary energy kWh/year			5680.7614 (286)

Full SAP Calculation Printout



Target Primary Energy Rate (TPER)

72.4600 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	29.5600 (1b)	x 2.5000 (2b)	= 73.9000 (1b) -
First floor	31.0800 (1c)	x 2.8000 (2c)	= 87.0240 (1c) -
Second floor	17.7600 (1d)	x 2.9000 (2d)	= 51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 212.4280 (5)

2. Ventilation rate

	m ³ 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	3 * 10 = 30.0000 (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) =	Air changes per hour
Pressure test	30.0000 / (5) = 0.1412 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.3412 (18)
	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3156 (21)

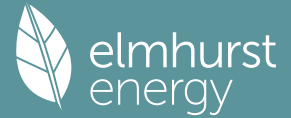
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4024	0.3945	0.3866	0.3472	0.3393	0.2999	0.2999	0.2920	0.3156	0.3393	0.3551	0.3709 (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	0.5810	0.5778	0.5747	0.5603	0.5576	0.5450	0.5450	0.5426	0.5498	0.5576	0.5630	0.5688 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			24.6900	1.1450	28.2710		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			29.5600	0.1000	2.9560	110.0000	3251.6000 (28a)
External Wall	114.8000	24.6900	90.1100	0.1500	13.5165	9.0000	810.9900 (29a)
External Roof - Sloping	23.1800	4.0600	19.1200	0.1500	2.8680	9.0000	172.0800 (30)
External Roof - Flat Roof	13.3200		13.3200	0.1500	1.9980	9.0000	119.8800 (30)
Total net area of external elements Aum(A, m ²)			180.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0720		(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			105.3000			9.0000	947.7000 (32c)
Internal Floor - 1st Floor			29.5600			18.0000	532.0800 (32d)
Internal Floor - 2nd Floor			17.7600			18.0000	319.6800 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10368.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							132.2486 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				13.1000	0.0580	0.7598	
E3 Sill				8.6000	0.0450	0.3870	

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	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901	121.5901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.9795	120.6559	108.9795	112.6122	108.9795	112.6122	108.9795	108.9795	112.6122	108.9795	112.6122	108.9795 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.0641	218.3061	212.6562	200.6281	185.4449	171.1748	161.6414	159.3994	165.0493	177.0774	192.2606	206.5308 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590 (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)												

Full SAP Calculation Printout



	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720 (71)
Water heating gains (Table 5)	48.0712	46.8605	44.9916	41.5092	39.2127	36.8553	35.6980	37.1109	38.6996	41.2903	44.6563	47.6812 (72)
Total internal gains	432.5918	445.2996	426.1043	414.2266	393.1141	380.1193	365.7960	364.9668	375.8381	386.8242	409.0061	422.6685 (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	7.4800	10.6334	0.6300	0.7000	0.7700	24.3078 (74)
East	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (76)
South	12.8900	46.7521	0.6300	0.7000	0.7700	184.1728 (78)
East	4.0600	26.2379	0.6300	0.7000	1.0000	42.2802 (82)

Solar gains	276.6908	483.6742	691.9489	903.5328	1051.0032	1059.6973	1014.9428	902.9929	765.2143	542.9556	333.7291	235.2550 (83)
Total gains	709.2826	928.9737	1118.0532	1317.7594	1444.1173	1439.8165	1380.7388	1267.9597	1141.0523	929.7797	742.7352	657.9235 (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	25.8781	25.9294	25.9800	26.2200	26.2654	26.4788	26.4788	26.5187	26.3962	26.2654	26.1737	26.0785
alpha	2.7252	2.7286	2.7320	2.7480	2.7510	2.7653	2.7653	2.7679	2.7597	2.7510	2.7449	2.7386
util living area	0.9539	0.9119	0.8478	0.7363	0.5968	0.4477	0.3343	0.3753	0.5697	0.8032	0.9241	0.9615 (86)
MIT	18.6119	19.0970	19.6655	20.2714	20.6792	20.8950	20.9653	20.9517	20.7907	20.2002	19.2891	18.5222 (87)
Th 2	19.7484	19.7505	19.7526	19.7625	19.7644	19.7730	19.7730	19.7746	19.7697	19.7644	19.7606	19.7567 (88)
util rest of house	0.9454	0.8967	0.8227	0.6958	0.5391	0.3725	0.2459	0.2824	0.4912	0.7612	0.9082	0.9542 (89)
MIT 2	17.6294	18.0996	18.6410	19.2016	19.5496	19.7195	19.7616	19.7574	19.6514	19.1606	18.3026	17.5474 (90)
Living area fraction	17.9748	18.4502	19.0012	19.5777	19.9467	20.1327	20.1847	20.1772	20.0519	19.5261	18.6494	0.3515 (91)
MIT	17.9748	18.4502	19.0012	19.5777	19.9467	20.1327	20.1847	20.1772	20.0519	19.5261	18.6494	17.8901 (92)
Temperature adjustment	17.9748	18.4502	19.0012	19.5777	19.9467	20.1327	20.1847	20.1772	20.0519	19.5261	18.6494	0.0000
adjusted MIT	17.9748	18.4502	19.0012	19.5777	19.9467	20.1327	20.1847	20.1772	20.0519	19.5261	18.6494	17.8901 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9292	0.8771	0.8050	0.6892	0.5481	0.3953	0.2762	0.3138	0.5103	0.7519	0.8902	0.9394 (94)
Useful gains	659.0768	814.7666	900.0759	908.1727	791.5442	569.1808	381.3559	397.8374	582.2833	699.1422	661.1586	618.0838 (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	1521.9247	1505.0709	1385.8512	1172.8666	904.2729	601.7884	389.9074	410.2250	649.4103	978.7729	1270.8587	1511.9148 (97)
Space heating kWh	641.9589	463.8845	361.4168	190.5796	83.8702	0.0000	0.0000	0.0000	0.0000	208.0452	438.9840	665.0103 (98a)
Space heating requirement - total per year (kWh/year)												3053.7495
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	641.9589	463.8845	361.4168	190.5796	83.8702	0.0000	0.0000	0.0000	0.0000	208.0452	438.9840	665.0103 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3053.7495
Space heating per m2										(98c) / (4) =		38.9509 (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	1022.4303	804.8919	825.4018	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8704	0.9117	0.8908	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	889.9698	733.8230	735.2267	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1592.4301	1528.0843	1405.7973	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	505.7714	590.9304	498.9045	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	126.4428	147.7326	124.7261	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												398.9016 (107)
Energy for space heating												38.9509 (99)
Energy for space cooling												5.0880 (108)
Total												44.0389 (109)

Full SAP Calculation Printout



Fabric Energy Efficiency (DFEE)

44.0 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	29.5600 (1b)	x 2.5000 (2b)	= 73.9000 (1b) -
First floor	31.0800 (1c)	x 2.8000 (2c)	= 87.0240 (1c) -
Second floor	17.7600 (1d)	x 2.9000 (2d)	= 51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 212.4280 (5)

2. Ventilation rate

	m ³ 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	3 * 10 = 30.0000 (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) =	30.0000 / (5) =	0.1412 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3912 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3619 (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	0.4614	0.4524	0.4433	0.3981	0.3890	0.3438	0.3438	0.3347	0.3619	0.3890	0.4071	0.4252 (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	0.6064	0.6023	0.5983	0.5792	0.5757	0.5591	0.5591	0.5560	0.5655	0.5757	0.5829	0.5904 (25)

3. Heat losses and heat loss parameter

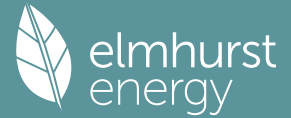
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			16.8400	1.1450	19.2824		(27)
Rooflights			2.7700	1.5038	4.1654		(27a)
Ground Floor			29.5600	0.1300	3.8428		(28a)
External Wall	114.8000	16.8400	97.9600	0.1800	17.6328		(29a)
External Roof - Sloping	23.1800	2.7700	20.4100	0.1100	2.2451		(30)
External Roof - Flat Roof	13.3200		13.3200	0.1100	1.4652		(30)
Total net area of external elements Aum(A, m ²)			180.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.6338		(33)
Party Wall 1			54.1200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 132.2486 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.1000	0.0500	0.6550
E3 Sill	8.6000	0.0500	0.4300
E4 Jamb	47.2000	0.0500	2.3600
E5 Ground floor (normal)	15.8000	0.1600	2.5280
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0400	0.1920
E13 Gable (insulation at rafter level)	9.6000	0.0800	0.7680
E15 Flat roof with parapet	7.0000	0.5600	3.9200

Full SAP Calculation Printout



E16 Corner (normal)	12.1000	0.0900	1.0890
E18 Party wall between dwellings	2.5000	0.0600	0.1500
E25 Staggered party wall between dwellings	14.6000	0.0600	0.8760
P1 Party wall - Ground floor	7.6000	0.0800	0.6080
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.1200	0.3960
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.0800	0.3840
R1 Head of roof window	3.1000	0.0800	0.2480
R2 Sill of roof window	3.1000	0.0600	0.1860
R3 Jamb of roof window	4.8000	0.0800	0.3840
R4 Ridge (vaulted ceiling)	4.8000	0.0800	0.3840
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.3330 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	63.9668 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.5126	Feb 42.2228	Mar 41.9388	Apr 40.6048	May 40.3552	Jun 39.1933	Jul 39.1933	Aug 38.9781	Sep 39.6408	Oct 40.3552	Nov 40.8601	Dec 41.3880 (38)
Heat transfer coeff	106.4793	106.1896	105.9055	104.5715	104.3219	103.1600	103.1600	102.9449	103.6076	104.3219	104.8268	105.3547 (39)
Average = Sum(39)m / 12 =												104.5703
HLP	Jan 1.3582	Feb 1.3545	Mar 1.3508	Apr 1.3338	May 1.3306	Jun 1.3158	Jul 1.3158	Aug 1.3131	Sep 1.3215	Oct 1.3306	Nov 1.3371	Dec 1.3438 (40)
HLP (average)												1.3338
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

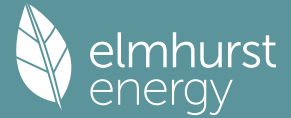
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4318 (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	28.0723	27.6554	27.0683	25.9858	25.1752	24.2765	23.7910	24.3740	25.0087	25.9705	27.0753	27.9774 (42b)
Hot water usage for other uses	39.5341	38.0965	36.6589	35.2213	33.7837	32.3461	32.3461	33.7837	35.2213	36.6589	38.0965	39.5341 (42c)
Average daily hot water use (litres/day)												61.9676 (43)
Daily hot water use	Jan 67.6064	Feb 65.7519	Mar 63.7272	Apr 61.2071	May 58.9589	Jun 56.6225	Jul 56.1370	Aug 58.1576	Sep 60.2300	Oct 62.6294	Nov 65.1718	Dec 67.5115 (44)
Energy content (annual)	107.0720	93.6298	97.9463	83.7894	79.3700	69.6240	67.8929	72.0113	74.2696	84.9874	92.8491	105.7067 (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	1029.1487
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	91.0112	79.5854	83.2544	71.2210	67.4645	59.1804	57.7089	61.2096	63.1292	72.2393	78.9217	89.8507 (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	91.0112	79.5854	83.2544	71.2210	67.4645	59.1804	57.7089	61.2096	63.1292	72.2393	78.9217	89.8507 (64)
12Total per year (kWh/year)												874.7764 (64)
Electric shower(s)	52.0486	46.3757	50.6405	48.3256	49.2324	46.9629	48.5284	49.2324	48.3256	50.6405	49.6883	52.0486 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												592.0494 (64a)
Heat gains from water heating, kWh/month	35.7650	31.4903	33.4737	29.8867	29.1742	26.5358	26.5593	27.6105	27.8637	30.7200	32.1525	35.4748 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 121.5901	Feb 121.5901	Mar 121.5901	Apr 121.5901	May 121.5901	Jun 121.5901	Jul 121.5901	Aug 121.5901	Sep 121.5901	Oct 121.5901	Nov 121.5901	Dec 121.5901 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.9795	120.6559	108.9795	112.6122	108.9795	112.6122	108.9795	108.9795	112.6122	108.9795	112.6122	108.9795 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.0641	218.3061	212.6562	200.6281	185.4449	171.1748	161.6414	159.3994	165.0493	177.0774	192.2606	206.5308 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590	35.1590 (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)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720 (71)
Water heating gains (Table 5)	48.0712	46.8605	44.9916	41.5092	39.2127	36.8553	35.6980	37.1109	38.6996	41.2903	44.6563	47.6812 (72)
Total internal gains	432.5918	445.2996	426.1043	414.2266	393.1141	380.1193	365.7960	364.9668	375.8381	386.8242	409.0061	422.6685 (73)

Full SAP Calculation Printout



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				5.1000	10.6334	0.6300	0.7000		0.7700		16.5735 (74)	
East				2.9500	19.6403	0.6300	0.7000		0.7700		17.7068 (76)	
South				8.7900	46.7521	0.6300	0.7000		0.7700		125.5919 (78)	
East				2.7700	26.2379	0.6300	0.7000		1.0000		28.8463 (82)	
Solar gains	188.7185	329.9011	471.9770	616.3181	716.9228	722.8570	692.3269	615.9549	521.9586	370.3405	227.6235	160.4559 (83)
Total gains	621.3103	775.2007	898.0812	1030.5446	1110.0368	1102.9762	1058.1229	980.9217	897.7967	757.1646	636.6295	583.1244 (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	27.0483	27.1221	27.1948	27.5417	27.6076	27.9186	27.9186	27.9769	27.7980	27.6076	27.4746	27.3370
alpha	2.8032	2.8081	2.8130	2.8361	2.8405	2.8612	2.8612	2.8651	2.8532	2.8405	2.8316	2.8225
util living area	0.9652	0.9376	0.8946	0.8098	0.6880	0.5344	0.4064	0.4498	0.6513	0.8548	0.9436	0.9704 (86)
MIT	18.5789	18.9789	19.4927	20.1090	20.5726	20.8529	20.9503	20.9327	20.7300	20.0939	19.2306	18.5166 (87)
Th 2	19.7956	19.7984	19.8012	19.8144	19.8169	19.8285	19.8285	19.8306	19.8240	19.8169	19.8119	19.8067 (88)
util rest of house	0.9586	0.9263	0.8754	0.7758	0.6331	0.4546	0.3068	0.3474	0.5745	0.8205	0.9315	0.9647 (89)
MIT 2	17.6296	18.0217	18.5199	19.1075	19.5189	19.7495	19.8109	19.8049	19.6636	19.1125	18.2838	17.5758 (90)
Living area fraction									fLA = Living area / (4) =			0.3515 (91)
MIT	17.9633	18.3582	18.8619	19.4595	19.8893	20.1374	20.2114	20.2014	20.0385	19.4575	18.6166	17.9065 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9633	18.3582	18.8619	19.4595	19.8893	20.1374	20.2114	20.2014	20.0385	19.4575	18.6166	17.9065 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9451	0.9090	0.8573	0.7643	0.6367	0.4767	0.3404	0.3812	0.5896	0.8082	0.9155	0.9524 (94)
Useful gains	587.1896	704.6736	769.9538	787.6247	706.8114	525.7355	360.1566	373.9290	529.3690	611.9079	582.8511	555.3666 (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	1454.8594	1429.1218	1309.1905	1104.2259	854.3201	571.2345	372.5548	391.3334	615.2688	924.0313	1207.2499	1444.0425 (97)
Space heating kWh	645.5463	486.8292	401.1921	227.9528	109.7465	0.0000	0.0000	0.0000	0.0000	232.2198	449.5672	661.1749 (98a)
Space heating requirement - total per year (kWh/year)												3214.2289
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	645.5463	486.8292	401.1921	227.9528	109.7465	0.0000	0.0000	0.0000	0.0000	232.2198	449.5672	661.1749 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3214.2289
Space heating per m2										(98c) / (4) =		40.9978 (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	969.7042	763.3842	782.3809	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8176	0.8723	0.8471	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.8677	665.8938	662.7212	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1214.1978	1165.6573	1082.6011	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	303.3577	371.8241	312.3906	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	75.8394	92.9560	78.0977	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												246.8931 (107)
Energy for space heating												40.9978 (99)
Energy for space cooling												3.1491 (108)
Total												44.1470 (109)
Fabric Energy Efficiency (TFEE)												44.1 (109)

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	29.5600 (1b)	x	2.5000 (2b)	=	73.9000 (1b)	-
First floor	31.0800 (1c)	x	2.8000 (2c)	=	87.0240 (1c)	-
Second floor	17.7600 (1d)	x	2.9000 (2d)	=	51.5040 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000				(4)	
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	212.4280 (5)

2. Ventilation rate

	m ³ 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	3 * 10 =	30.0000 (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) =	Air changes per hour 30.0000 / (5) =	0.1412 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000 (17)	
Infiltration rate	0.3412 (18)	
Number of sides sheltered	1 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3156 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4024	0.3945	0.3866	0.3472	0.3393	0.2999	0.2999	0.2920	0.3156	0.3393	0.3551	0.3709	(22b)
	0.5810	0.5778	0.5747	0.5603	0.5576	0.5450	0.5450	0.5426	0.5498	0.5576	0.5630	0.5688	(25)

3. Heat losses and heat loss parameter

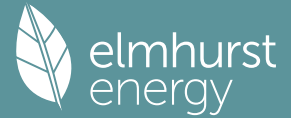
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows/Doors (Uw = 1.20)			24.6900	1.1450	28.2710			(27)
Rooflights			4.0600	1.5918	6.4625			(27a)
Ground Floor			29.5600	0.1000	2.9560	110.0000	3251.6000	(28a)
External Wall	114.8000	24.6900	90.1100	0.1500	13.5165	9.0000	810.9900	(29a)
External Roof - Sloping	23.1800	4.0600	19.1200	0.1500	2.8680	9.0000	172.0800	(30)
External Roof - Flat Roof	13.3200		13.3200	0.1500	1.9980	9.0000	119.8800	(30)
Total net area of external elements Aum(A, m ²)			180.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.0720			(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000	(32)
Internal Walls - Timber			105.3000			9.0000	947.7000	(32c)
Internal Floor - 1st Floor			29.5600			18.0000	532.0800	(32d)
Internal Floor - 2nd Floor			17.7600			18.0000	319.6800	(32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400	(32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10368.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 132.2486 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.1000	0.0580	0.7598
E3 Sill	8.6000	0.0450	0.3870
E4 Jamb	47.2000	0.0500	2.3600
E5 Ground floor (normal)	15.8000	0.0550	0.8690
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624
E15 Flat roof with parapet	7.0000	0.3000	2.1000
E16 Corner (normal)	12.1000	0.0440	0.5324
E18 Party wall between dwellings	2.5000	0.0370	0.0925

Full SAP Calculation Printout



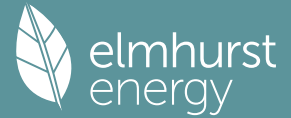
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402
P1 Party wall - Ground floor	7.6000	0.0490	0.3724
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	4.8000	0.2400	1.1520
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.4951 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	70.5671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.7271	Feb 40.5067	Mar 40.2906	Apr 39.2758	May 39.0859	Jun 38.2020	Jul 38.2020	Aug 38.0384	Sep 38.5425	Oct 39.0859	Nov 39.4700	Dec 39.8716 (38)
Heat transfer coeff	111.2942	111.0738	110.8578	109.8429	109.6531	108.7692	108.7692	108.6055	109.1096	109.6531	110.0372	110.4387 (39)
Average = Sum(39)m / 12 =												109.8420
HLP	Jan 1.4196	Feb 1.4168	Mar 1.4140	Apr 1.4011	May 1.3986	Jun 1.3874	Jul 1.3874	Aug 1.3853	Sep 1.3917	Oct 1.3986	Nov 1.4035	Dec 1.4087 (40)
HLP (average)												1.4010
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4318 (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	78.8836	77.7121	76.0623	73.0204	70.7427	68.2171	66.8529	68.4911	70.2748	72.9773	76.0818	78.6169 (42b)
Hot water usage for other uses	41.6148	40.1016	38.5883	37.0750	35.5618	34.0485	34.0485	35.5618	37.0750	38.5883	40.1016	41.6148 (42c)
Average daily hot water use (litres/day)												110.9692 (43)
Daily hot water use	Jan 120.4984	Feb 117.8136	Mar 114.6506	Apr 110.0955	May 106.3045	Jun 102.2656	Jul 100.9014	Aug 104.0529	Sep 107.3499	Oct 111.5656	Nov 116.1834	Dec 120.2317 (44)
Energy content (annual)	190.8400	167.7650	176.2137	150.7152	143.1063	125.7475	122.0315	128.8392	132.3731	151.3935	165.5245	188.2538 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1842.8033
Water storage loss:												
Store volume	28.6260	25.1648	26.4321	22.6073	21.4659	18.8621	18.3047	19.3259	19.8560	22.7090	24.8287	28.2381 (46)
a) If manufacturer declared loss factor is known (kWh/day):												150.0000 (47)
Temperature factor from Table 2b												1.8600 (48)
Enter (49) or (54) in (55)												0.5400 (49)
Total storage loss												1.0044 (55)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
Primary loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Combi 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)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	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)
Electric shower(s)	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526 (64)
Total per year (kWh/year) = Sum(64)m =												2483.3053 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	106.9734	95.0894	102.1101	92.2280	91.1019	83.9262	84.0945	86.3581	86.1293	93.8574	97.1521	106.1134 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 145.9081	Feb 145.9081	Mar 145.9081	Apr 145.9081	May 145.9081	Jun 145.9081	Jul 145.9081	Aug 145.9081	Sep 145.9081	Oct 145.9081	Nov 145.9081	Dec 145.9081 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7259	21.9613	17.8601	13.5213	10.1073	8.5330	9.2202	11.9848	16.0860	20.4248	23.8388	25.4131 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.4837	325.8301	317.3973	299.4450	276.7834	255.4847	241.2559	237.9095	246.3423	264.2946	286.9562	308.2549 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226 (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)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720 (71)
Water heating gains (Table 5)	143.7814	141.5021	137.2447	128.0944	122.4488	116.5642	113.0302	116.0727	119.6240	126.1524	134.9335	142.6256 (72)
Total internal gains	591.6496	589.9520	573.1608	541.7193	509.9981	481.2406	464.1650	466.6256	482.7108	511.5304	546.3871	576.9521 (73)

Full SAP Calculation Printout



6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4800	10.6334	0.6300	0.7000	0.7700	24.3078 (74)
East	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (76)
South	12.8900	46.7521	0.6300	0.7000	0.7700	184.1728 (78)
East	4.0600	26.2379	0.6300	0.7000	1.0000	42.2802 (82)
Solar gains	276.6908	483.6742	691.9489	903.5328	1051.0032	1059.6973
Total gains	868.3404	1073.6262	1265.1097	1445.2521	1561.0013	1540.9378
						1014.9428
						902.9929
						765.2143
						542.9556
						333.7291
						235.2550 (83)
						812.2071 (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	25.8781	25.9294	25.9800	26.2200	26.2654	26.4788	26.4788	26.5187	26.3962	26.2654	26.1737	26.0785
alpha	2.7252	2.7286	2.7320	2.7480	2.7510	2.7653	2.7653	2.7679	2.7597	2.7510	2.7449	2.7386
util living area	0.9289	0.8833	0.8126	0.7018	0.5652	0.4228	0.3138	0.3502	0.5335	0.7614	0.8934	0.9387 (86)
Living	19.2934	19.6139	20.0086	20.4090	20.6792	20.8209	20.8670	20.8588	20.7560	20.3743	19.7573	19.2270
Non living	17.8085	18.2028	18.6796	19.1508	19.4433	19.5866	19.6215	19.6187	19.5323	19.1318	18.3970	17.7323
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1270	19.6139	20.0086	20.4090	20.6792	20.8209	20.8670	20.8588	20.7560	20.3743	19.7573	19.4750 (87)
Th 2	19.7484	19.7505	19.7526	19.7625	19.7644	19.7730	19.7730	19.7746	19.7697	19.7644	19.7606	19.7567 (88)
util rest of house	0.9165	0.8645	0.7842	0.6596	0.5081	0.3505	0.2301	0.2625	0.4569	0.7155	0.8728	0.9279 (89)
MIT 2	18.9750	18.2028	18.6796	19.1508	19.4433	19.5866	19.6215	19.6187	19.5323	19.1318	18.3970	18.0971 (90)
Living area fraction	19.3800	18.6988	19.1468	19.5931	19.8778	20.0205	20.0593	20.0547	fLA = Living area / (4) =			
MIT	19.3800	18.6988	19.1468	19.5931	19.8778	20.0205	20.0593	20.0547	19.9625	19.5686	18.8752	18.5815 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3800	18.6988	19.1468	19.5931	19.8778	20.0205	20.0593	20.0547	19.9625	19.5686	18.8752	18.5815 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9124	0.8457	0.7685	0.6534	0.5137	0.3656	0.2501	0.2831	0.4696	0.7073	0.8550	0.9152 (94)
Useful gains	792.2414	907.9556	972.1743	944.2979	801.8091	563.3324	369.8621	387.6844	586.0030	745.8730	752.4848	743.3537 (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	1678.3121	1532.6884	1401.9960	1174.5584	896.7163	589.5837	376.2679	396.9169	639.6517	983.4310	1295.7044	1588.2737 (97)
Space heating kWh	659.2366	419.8204	319.7874	165.7876	70.6109	0.0000	0.0000	0.0000	0.0000	176.7432	391.1181	628.6205 (98a)
Space heating requirement - total per year (kWh/year)												2831.7247
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	659.2366	419.8204	319.7874	165.7876	70.6109	0.0000	0.0000	0.0000	0.0000	176.7432	391.1181	628.6205 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2831.7247
Space heating per m2										(98c) / (4) =		36.1189 (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 %)												350.2501 (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	659.2366	419.8204	319.7874	165.7876	70.6109	0.0000	0.0000	0.0000	0.0000	176.7432	391.1181	628.6205 (98)
Space heating efficiency (main heating system 1)	350.2501	350.2501	350.2501	350.2501	350.2501	0.0000	0.0000	0.0000	0.0000	350.2501	350.2501	350.2501 (210)
Space heating fuel (main heating system)	188.2188	119.8630	91.3026	47.3341	20.1601	0.0000	0.0000	0.0000	0.0000	50.4620	111.6682	179.4776 (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)

Full SAP Calculation Printout



Water heating requirement	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526 (64)
Efficiency of water heater (217)m	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119 (216)
Fuel for water heating, kWh/month	130.0920	115.0587	122.3331	107.8760	104.7706	94.6314	93.5911	97.2023	98.1461	109.1667	115.7320	128.7201 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	21.6424	17.3623	15.6329	11.4533	8.8469	7.2280	8.0704	10.4902	13.6258	17.8777	20.1928	22.2439 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)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 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												808.4864 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												188.5119
Water heating fuel used												1317.3202 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												174.6666 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (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												2300.4732 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	808.4864	16.4900	133.3194 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1317.3202	16.4900	217.2261 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	174.6666	16.4900	28.8025 (250)
Additional standing charges			0.0000 (251)
Total energy cost			379.3480 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1067 (257)
SAP value		82.0606
SAP rating (Section 12)		82 (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	808.4864	0.1561	126.2365 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1317.3202	0.1408	185.4958 (264)
Space and water heating			311.7323 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	174.6666	0.1443	25.2098 (268)
Total CO2, kg/year			336.9421 (272)
CO2 emissions per m2			4.3000 (273)
EI value			96.3411
EI rating			96 (274)

Full SAP Calculation Printout



EI band

A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	29.5600 (1b)	x 2.5000 (2b)	= 73.9000 (1b) -
First floor	31.0800 (1c)	x 2.8000 (2c)	= 87.0240 (1c) -
Second floor	17.7600 (1d)	x 2.9000 (2d)	= 51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 212.4280 (5)

2. Ventilation rate

	m ³ 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	3 * 10 = 30.0000 (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) =	Air changes per hour	30.0000 / (5) = 0.1412 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			4.0000 (17)
Infiltration rate			0.3412 (18)
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3156 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3393	0.3235	0.3235	0.2999	0.3077	0.2683	0.2683	0.2604	0.2683	0.2999	0.2920	0.3156 (22b)
Effective ac	0.5576	0.5523	0.5523	0.5450	0.5474	0.5360	0.5360	0.5339	0.5360	0.5450	0.5426	0.5498 (25)

3. Heat losses and heat loss parameter

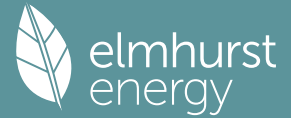
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			24.6900	1.1450	28.2710		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			29.5600	0.1000	2.9560	110.0000	3251.6000 (28a)
External Wall	114.8000	24.6900	90.1100	0.1500	13.5165	9.0000	810.9900 (29a)
External Roof - Sloping	23.1800	4.0600	19.1200	0.1500	2.8680	9.0000	172.0800 (30)
External Roof - Flat Roof	13.3200		13.3200	0.1500	1.9980	9.0000	119.8800 (30)
Total net area of external elements Aum(A, m ²)			180.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.0720		(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			105.3000			9.0000	947.7000 (32c)
Internal Floor - 1st Floor			29.5600			18.0000	532.0800 (32d)
Internal Floor - 2nd Floor			17.7600			18.0000	319.6800 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10368.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		132.2486 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.1000	0.0580	0.7598
E3 Sill	8.6000	0.0450	0.3870
E4 Jamb	47.2000	0.0500	2.3600
E5 Ground floor (normal)	15.8000	0.0550	0.8690

Full SAP Calculation Printout



E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624
E15 Flat roof with parapet	7.0000	0.3000	2.1000
E16 Corner (normal)	12.1000	0.0440	0.5324
E18 Party wall between dwellings	2.5000	0.0370	0.0925
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402
P1 Party wall - Ground floor	7.6000	0.0490	0.3724
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	4.8000	0.2400	1.1520
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.4951 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			70.5671 (37) (33) + (36) + (36a) =

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	39.0859	38.7193	38.7193	38.2020	38.3701	37.5735	37.5735	37.4273	37.5735	38.2020	38.0384	38.5425	(38)
Average = Sum(39)m / 12 =	109.6531	109.2864	109.2864	108.7692	108.9372	108.1406	108.1406	107.9944	108.1406	108.7692	108.6055	109.1096	(39)
												108.7361	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.3986	1.3940	1.3940	1.3874	1.3895	1.3793	1.3793	1.3775	1.3793	1.3874	1.3853	1.3917	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

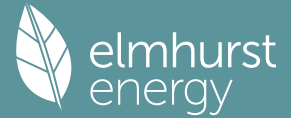
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4318 (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	78.8836	77.7121	76.0623	73.0204	70.7427	68.2171	66.8529	68.4911	70.2748	72.9773	76.0818	78.6169	(42b)
Hot water usage for other uses	41.6148	40.1016	38.5883	37.0750	35.5618	34.0485	34.0485	35.5618	37.0750	38.5883	40.1016	41.6148	(42c)
Average daily hot water use (litres/day)													110.9692 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	120.4984	117.8136	114.6506	110.0955	106.3045	102.2656	100.9014	104.0529	107.3499	111.5656	116.1834	120.2317	(44)
Energy content (annual)	190.8400	167.7650	176.2137	150.7152	143.1063	125.7475	122.0315	128.8392	132.3731	151.3935	165.5245	188.2538	(45)
Distribution loss (46)m = 0.15 x (45)m													
	28.6260	25.1648	26.4321	22.6073	21.4659	18.8621	18.3047	19.3259	19.8560	22.7090	24.8287	28.2381	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(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													
	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526	(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													
	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526	(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													
	106.9734	95.0894	102.1101	92.2280	91.1019	83.9262	84.0945	86.3581	86.1293	93.8574	97.1521	106.1134	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	(66)
	24.7259	21.9613	17.8601	13.5213	10.1073	8.5330	9.2202	11.9848	16.0860	20.4248	23.8388	25.4131	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.4837	325.8301	317.3973	299.4450	276.7834	255.4847	241.2559	237.9095	246.3423	264.2946	286.9562	308.2549	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	(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)

Full SAP Calculation Printout



Losses e.g. evaporation (negative values) (Table 5)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720 (71)
Water heating gains (Table 5)	143.7814	141.5021	137.2447	128.0944	122.4488	116.5642	113.0302	116.0727	119.6240	126.1524	134.9335	142.6256 (72)
Total internal gains	591.6496	589.9520	573.1608	541.7193	509.9981	481.2406	464.1650	466.6256	482.7108	511.5304	546.3871	576.9521 (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				7.4800	12.7650		0.6300		0.7000		0.7700		29.1807 (74)
East				4.3200	23.8018		0.6300		0.7000		0.7700		31.4242 (76)
South				12.8900	54.2217		0.6300		0.7000		0.7700		213.5984 (78)
East				4.0600	31.9987		0.6300		0.7000		1.0000		51.5631 (82)
Solar gains	325.7664	498.1412	709.8154	946.2107	1077.2611	1151.1353	1090.7626	991.3805	838.5099	600.7655	387.1509	278.5454	(83)
Total gains	917.4160	1088.0932	1282.9762	1487.9300	1587.2592	1632.3759	1554.9276	1458.0061	1321.2208	1112.2959	933.5379	855.4976	(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	26.2654	26.3535	26.3535	26.4788	26.4380	26.6327	26.6327	26.6688	26.6327	26.4788	26.5187	26.3962
alpha	2.7510	2.7569	2.7569	2.7653	2.7625	2.7755	2.7755	2.7779	2.7755	2.7653	2.7679	2.7597
util living area	0.9110	0.8666	0.7852	0.6538	0.5011	0.3325	0.2265	0.2477	0.4538	0.7068	0.8635	0.9225 (86)
Living	19.5053	19.7763	20.1582	20.5307	20.7562	20.8597	20.8824	20.8805	20.8141	20.5114	19.9628	19.4452
Non living	18.0837	18.4154	18.8695	19.2944	19.5257	19.6220	19.6357	19.6366	19.5904	19.2896	18.6569	18.0145
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2354	19.7763	20.1582	20.5307	20.7562	20.8597	20.8824	20.8805	20.8141	20.5114	19.9628	19.6627 (87)
Th 2	19.7644	19.7680	19.7680	19.7730	19.7714	19.7792	19.7792	19.7806	19.7792	19.7730	19.7746	19.7697 (88)
util rest of house	0.8956	0.8450	0.7527	0.6065	0.4384	0.2588	0.1440	0.1607	0.3731	0.6526	0.8373	0.9087 (89)
MIT 2	19.0943	18.4154	18.8695	19.2944	19.5257	19.6220	19.6357	19.6366	19.5904	19.2896	18.6569	18.3308 (90)
Living area fraction	19.4955	18.8938	19.3225	19.7290	19.9583	20.0571	20.0740	20.0739	20.0206	19.7191	19.1159	0.3515 (91)
MIT	19.4955	18.8938	19.3225	19.7290	19.9583	20.0571	20.0740	20.0739	20.0206	19.7191	19.1159	18.7990 (92)
Temperature adjustment	19.4955	18.8938	19.3225	19.7290	19.9583	20.0571	20.0740	20.0739	20.0206	19.7191	19.1159	0.0000
adjusted MIT	19.4955	18.8938	19.3225	19.7290	19.9583	20.0571	20.0740	20.0739	20.0206	19.7191	19.1159	18.7990 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	818.1040	899.8719	948.7237	899.6512	711.6321	450.4303	255.2774	265.2020	514.8561	722.9747	766.1085	766.0885 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	1578.5060	1441.9013	1302.9701	1069.0894	768.9084	460.3643	256.7244	267.1622	542.9305	893.9854	1207.2524	1494.6902 (97)
Space heating kWh	565.7391	364.2437	263.5593	121.9955	42.6135	0.0000	0.0000	0.0000	0.0000	127.2320	317.6236	542.0797 (98a)
Space heating requirement - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2345.0864
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	565.7391	364.2437	263.5593	121.9955	42.6135	0.0000	0.0000	0.0000	0.0000	127.2320	317.6236	542.0797 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2345.0864
Space heating per m2	(98c) / (4) = 29.9118 (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 %)	350.4515 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
565.7391	364.2437	263.5593	121.9955	42.6135	0.0000	0.0000	0.0000	0.0000	0.0000	127.2320	317.6236	542.0797 (98)
Space heating efficiency (main heating system 1)	350.4515	350.4515	350.4515	350.4515	350.4515	0.0000	0.0000	0.0000	0.0000	350.4515	350.4515	350.4515 (210)
Space heating fuel (main heating system)	161.4315	103.9356	75.2057	34.8109	12.1596	0.0000	0.0000	0.0000	0.0000	36.3052	90.6327	154.6804 (211)

Full SAP Calculation Printout



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	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	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	0.0000	(215)
Water heating														
Water heating requirement	245.2388	216.8994	230.6125	203.3592	197.5051	178.3915	176.4303	183.2380	185.0171	205.7923	218.1685	242.6526	188.5953	(64)
Efficiency of water heater	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	(216)
Fuel for water heating, kWh/month	130.0345	115.0079	122.2790	107.8284	104.7243	94.5896	93.5497	97.1594	98.1027	109.1185	115.6808	128.6632	188.5953	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	(231)
Lighting	21.6424	17.3623	15.6329	11.4533	8.8469	7.2280	8.0704	10.4902	13.6258	17.8777	20.1928	22.2439	0.0000	(232)
Electricity generated by PVs (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	0.0000	(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	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	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	0.0000	(235c)
Electricity generated by PVs (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	0.0000	(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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1														669.1615 (211)
Space heating fuel - main system 2														0.0000 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														188.5953
Water heating fuel used														1316.7378 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year														0.0000 (231)
Electricity for lighting (calculated in Appendix L)														174.6666 (232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation														0.0000 (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														2160.5659 (238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	669.1615	18.3900	123.0588 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1316.7378	18.3900	242.1481 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	174.6666	18.3900	32.1212 (250)
Additional standing charges			0.0000 (251)
Total energy cost			397.3281 (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	669.1615	0.1567	104.8685 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1316.7378	0.1408	185.4138 (264)
Space and water heating			290.2823 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	174.6666	0.1443	25.2098 (268)
Total CO2, kg/year			315.4920 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
--	--------------------	-------------------------------------	----------------------------

Full SAP Calculation Printout



Space heating - main system 1	669.1615	1.5801	1057.3632 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1316.7378	1.5207	2002.3250 (278)
Space and water heating			3059.6882 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	174.6666	1.5338	267.9094 (282)
Total Primary energy kWh/year			3327.5976 (286)

SAP 10 EPC IMPROVEMENTS

P22691(1)

Current energy efficiency rating: B 82
Current environmental impact rating: A 96

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 58	-40 kg (12.5%)
U Solar photovoltaic panels	+ 6.4	-£ 158	-116 kg (42.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£58	0.50 kg/m²	B 84 A 97
Solar photovoltaic panels	£158	1.48 kg/m²	B 91 A 98
Total Savings	£216	1.98 kg/m²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 511 TEST (31 Jan 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £397	Potential £339	Saving £58
Electricity			
Space heating	£123	£138	-£15
Water heating	£242	£169	£73
Lighting	£32	£32	£0
Generated (PV)	-£0	-£158	£158
Total cost of fuels	£397	£181	£216
Total cost of uses	£397	£181	£216
Delivered energy	28 kWh/m²	13 kWh/m²	15 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	2 kg/m²
Primary energy	42 kWh/m²	20 kWh/m²	22 kWh/m²

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

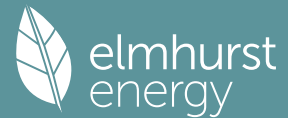
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	29.5600 (1b)	x 2.5000 (2b)	= 73.9000 (1b) -
First floor	31.0800 (1c)	x 2.8000 (2c)	= 87.0240 (1c) -
Second floor	17.7600 (1d)	x 2.9000 (2d)	= 51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	212.4280 (5)

2. Ventilation rate

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

Full SAP Calculation Printout



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	3 * 10 =	30.0000 (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) =	30.0000	Air changes per hour	30.0000 / (5) =	0.1412 (8)
Pressure test			Yes		
Pressure Test Method			Blower Door		
Measured/design AP50			4.0000		(17)
Infiltration rate			0.3412		(18)
Number of sides sheltered			1		(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3156 (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	0.4024	0.3945	0.3866	0.3472	0.3393	0.2999	0.2999	0.2920	0.3156	0.3393	0.3551	0.3709	(22b)
Effective ac	0.5810	0.5778	0.5747	0.5603	0.5576	0.5450	0.5450	0.5426	0.5498	0.5576	0.5630	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows/Doors (Uw = 1.20)			24.6900	1.1450	28.2710			(27)
Rooflights			4.0600	1.5918	6.4625			(27a)
Ground Floor			29.5600	0.1000	2.9560	110.0000	3251.6000	(28a)
External Wall	114.8000	24.6900	90.1100	0.1500	13.5165	9.0000	810.9900	(29a)
External Roof - Sloping	23.1800	4.0600	19.1200	0.1500	2.8680	9.0000	172.0800	(30)
External Roof - Flat Roof	13.3200		13.3200	0.1500	1.9980	9.0000	119.8800	(30)
Total net area of external elements Aum(A, m2)			180.8600					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.0720		(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000	(32)
Internal Walls - Timber			105.3000			9.0000	947.7000	(32c)
Internal Floor - 1st Floor			29.5600			18.0000	532.0800	(32d)
Internal Floor - 2nd Floor			17.7600			18.0000	319.6800	(32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400	(32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10368.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		132.2486 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	13.1000	0.0580	0.7598	
E3 Sill	8.6000	0.0450	0.3870	
E4 Jamb	47.2000	0.0500	2.3600	
E5 Ground floor (normal)	15.8000	0.0550	0.8690	
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000	
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728	
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624	
E15 Flat roof with parapet	7.0000	0.3000	2.1000	
E16 Corner (normal)	12.1000	0.0440	0.5324	
E18 Party wall between dwellings	2.5000	0.0370	0.0925	
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402	
P1 Party wall - Ground floor	7.6000	0.0490	0.3724	
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541	
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040	
R1 Head of roof window	3.1000	0.2400	0.7440	
R2 Sill of roof window	3.1000	0.2400	0.7440	
R3 Jamb of roof window	4.8000	0.2400	1.1520	
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275	

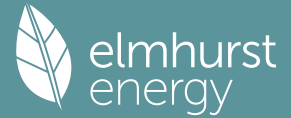
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.4951 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	70.5671 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.7271	40.5067	40.2906	39.2758	39.0859	38.2020	38.2020	38.0384	38.5425	39.0859	39.4700	39.8716	(38)
Heat transfer coeff	111.2942	111.0738	110.8578	109.8429	109.6531	108.7692	108.7692	108.6055	109.1096	109.6531	110.0372	110.4387	(39)
Average = Sum(39)m / 12 =												109.8420	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4196	1.4168	1.4140	1.4011	1.3986	1.3874	1.3874	1.3853	1.3917	1.3986	1.4035	1.4087	(40)
HLP (average)												1.4010	
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												2.4318 (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	78.8836	77.7121	76.0623	73.0204	70.7427	68.2171	66.8529	68.4911	70.2748	72.9773	76.0818	78.6169 (42b)
Hot water usage for other uses	41.6148	40.1016	38.5883	37.0750	35.5618	34.0485	34.0485	35.5618	37.0750	38.5883	40.1016	41.6148 (42c)
Average daily hot water use (litres/day)												110.9692 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	120.4984	117.8136	114.6506	110.0955	106.3045	102.2656	100.9014	104.0529	107.3499	111.5656	116.1834	120.2317 (44)
Distribution loss (46)m = 0.15 x (45)m	190.8400	167.7650	176.2137	150.7152	143.1063	125.7475	122.0315	128.8392	132.3731	151.3935	165.5245	188.2538 (45)
Total = Sum(45)m =												1842.8033
Water storage loss:	28.6260	25.1648	26.4321	22.6073	21.4659	18.8621	18.3047	19.3259	19.8560	22.7090	24.8287	28.2381 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	245.2388	216.8994	229.2167	196.6056	184.7107	165.7848	163.4033	171.1415	179.6142	204.3966	218.1685	242.6526 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												608.3186 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												608.3186
Solar input	-0.0000	-16.2332	-57.6078	-78.5959	-101.7763	-93.7363	-93.0624	-81.7977	-56.9312	-28.5780	-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	245.2388	200.6662	171.6090	118.0097	82.9345	72.0485	70.3409	89.3439	122.6830	175.8186	218.1685	242.6526 (64)
Total per year (kWh/year) = Sum(64)m =												1809.5143 (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	106.9734	95.0894	100.9935	86.8251	80.8664	73.8409	73.6729	76.6809	81.8070	92.7408	97.1521	106.1134 (65)

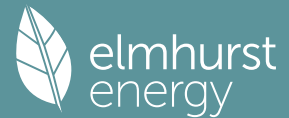
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7259	21.9613	17.8601	13.5213	10.1073	8.5330	9.2202	11.9848	16.0860	20.4248	23.8388	25.4131 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.4837	325.8301	317.3973	299.4450	276.7834	255.4847	241.2559	237.9095	246.3423	264.2946	286.9562	308.2549 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226 (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)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720 (71)
Water heating gains (Table 5)	143.7814	141.5021	135.7439	120.5904	108.6914	102.5567	99.0228	103.0657	113.6208	124.6516	134.9335	142.6256 (72)
Total internal gains	591.6496	589.9520	571.6600	534.2153	496.2408	467.2331	450.1575	453.6187	476.7076	510.0296	546.3871	576.9521 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.4800	10.6334	0.6300	0.7000	0.7700	24.3078 (74)
East	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (76)
South	12.8900	46.7521	0.6300	0.7000	0.7700	184.1728 (78)

Full SAP Calculation Printout



East	4.0600		26.2379		0.6300		0.7000		1.0000		42.2802 (82)	
Solar gains	276.6908	483.6742	691.9489	903.5328	1051.0032	1059.6973	1014.9428	902.9929	765.2143	542.9556	333.7291	235.2550 (83)
Total gains	868.3404	1073.6262	1263.6089	1437.7481	1547.2440	1526.9304	1465.1003	1356.6116	1241.9219	1052.9852	880.1162	812.2071 (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	25.8781	25.9294	25.9800	26.2200	26.2654	26.4788	26.4788	26.5187	26.3962	26.2654	26.1737	26.4785
alpha	2.7252	2.7286	2.7320	2.7480	2.7510	2.7653	2.7653	2.7679	2.7597	2.7510	2.7449	2.7386
util living area	0.9289	0.8833	0.8130	0.7038	0.5688	0.4261	0.3165	0.3533	0.5355	0.7619	0.8934	0.9387 (86)
Living	19.2934	19.6139	20.0075	20.4053	20.6758	20.8196	20.8665	20.8581	20.7548	20.3734	19.7573	19.2270
Non living	17.8085	18.2028	18.6783	19.1469	19.4402	19.5857	19.6213	19.6184	19.5313	19.1308	18.3970	17.7323
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1270	19.6139	20.0075	20.4053	20.6758	20.8196	20.8665	20.8581	20.7548	20.3734	19.7573	19.4750 (87)
Th 2	19.7484	19.7505	19.7526	19.7625	19.7644	19.7730	19.7730	19.7746	19.7697	19.7644	19.7606	19.7567 (88)
util rest of house	0.9165	0.8645	0.7845	0.6617	0.5116	0.3534	0.2322	0.2649	0.4587	0.7160	0.8728	0.9279 (89)
MIT 2	18.9750	18.2028	18.6783	19.1469	19.4402	19.5857	19.6213	19.6184	19.5313	19.1308	18.3970	18.0971 (90)
Living area fraction									fLA = Living area / (4) =			0.3515 (91)
MIT	19.3800	18.6988	19.1455	19.5893	19.8746	20.0194	20.0590	20.0542	19.9614	19.5676	18.8752	18.5815 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3800	18.6988	19.1455	19.5893	19.8746	20.0194	20.0590	20.0542	19.9614	19.5676	18.8752	18.5815 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9124	0.8457	0.7688	0.6553	0.5170	0.3685	0.2523	0.2856	0.4714	0.7078	0.8550	0.9152 (94)
Useful gains	792.2414	907.9556	971.4902	942.1755	799.9309	562.6887	369.6787	387.4267	585.3885	745.3380	752.4848	743.3537 (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	1678.3121	1532.6884	1401.8552	1174.1417	896.3655	589.4668	376.2332	396.8686	639.5376	983.3237	1295.7044	1588.2737 (97)
Space heating kWh	659.2366	419.8204	320.1916	167.0156	71.7474	0.0000	0.0000	0.0000	0.0000	177.0614	391.1181	628.6205 (98a)
Space heating requirement - total per year (kWh/year)												2834.8116
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	659.2366	419.8204	320.1916	167.0156	71.7474	0.0000	0.0000	0.0000	0.0000	177.0614	391.1181	628.6205 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2834.8116
Space heating per m2										(98c) / (4) =		36.1583 (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 %)												350.2501 (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	659.2366	419.8204	320.1916	167.0156	71.7474	0.0000	0.0000	0.0000	0.0000	177.0614	391.1181	628.6205 (98)
Space heating efficiency (main heating system 1)	350.2501	350.2501	350.2501	350.2501	350.2501	0.0000	0.0000	0.0000	0.0000	350.2501	350.2501	350.2501 (210)
Space heating fuel (main heating system)	188.2188	119.8630	91.4180	47.6847	20.4846	0.0000	0.0000	0.0000	0.0000	50.5528	111.6682	179.4776 (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	245.2388	200.6662	171.6090	118.0097	82.9345	72.0485	70.3409	89.3439	122.6830	175.8186	218.1685	242.6526 (64)
Efficiency of water heater (217)m	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119	188.5119 (216)
Fuel for water heating, kWh/month	130.0920	106.4475	91.0335	62.6007	43.9943	38.2196	37.3138	47.3943	65.0797	93.2666	115.7320	128.7201 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	21.6424	17.3623	15.6329	11.4533	8.8469	7.2280	8.0704	10.4902	13.6258	17.8777	20.1928	22.2439 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-37.5620	-55.0023	-80.9036	-90.8705	-95.5741	-86.7692	-85.5550	-81.2852	-72.9150	-62.5617	-41.6972	-32.0826 (233a)

10a. Fuel costs - using Table 12 prices

11a. SAP rating - Individual heating systems

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

Page 27 of 32

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)
Ground floor	29.5600 (1b)	x	2.5000 (2b)	=	73.9000 (1b) -
First floor	31.0800 (1c)	x	2.8000 (2c)	=	87.0240 (1c) -
Second floor	17.7600 (1d)	x	2.9000 (2d)	=	51.5040 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.4000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	212.4280 (5)

2. Ventilation rate

	m ³ 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	3 * 10 = 30.0000 (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) =	30.0000 / (5) =	0.1412 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000 (17)	
Infiltration rate		0.3412 (18)	
Number of sides sheltered		1 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3156 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3393	0.3235	0.3235	0.2999	0.3077	0.2683	0.2683	0.2604	0.2683	0.2999	0.2920	0.3156 (22b)
Effective ac	0.5576	0.5523	0.5523	0.5450	0.5474	0.5360	0.5360	0.5339	0.5360	0.5450	0.5426	0.5498 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			24.6900	1.1450	28.2710		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			29.5600	0.1000	2.9560	110.0000	3251.6000 (28a)
External Wall	114.8000	24.6900	90.1100	0.1500	13.5165	9.0000	810.9900 (29a)
External Roof - Sloping	23.1800	4.0600	19.1200	0.1500	2.8680	9.0000	172.0800 (30)
External Roof - Flat Roof	13.3200		13.3200	0.1500	1.9980	9.0000	119.8800 (30)
Total net area of external elements Aum(A, m ²)			180.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	56.0720			(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			105.3000			9.0000	947.7000 (32c)
Internal Floor - 1st Floor			29.5600			18.0000	532.0800 (32d)
Internal Floor - 2nd Floor			17.7600			18.0000	319.6800 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10368.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		132.2486 (35)

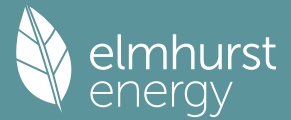
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.1000	0.0580	0.7598
E3 Sill	8.6000	0.0450	0.3870
E4 Jamb	47.2000	0.0500	2.3600
E5 Ground floor (normal)	15.8000	0.0550	0.8690
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728

elmhurst
energy

Page 29 of 32

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	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	145.9081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7259	21.9613	17.8601	13.5213	10.1073	8.5330	9.2202	11.9848	16.0860	20.4248	23.8388	25.4131	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.4837	325.8301	317.3973	299.4450	276.7834	255.4847	241.2559	237.9095	246.3423	264.2946	286.9562	308.2549	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	52.0226	(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)	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	-97.2720	(71)
Water heating gains (Table 5)	143.7814	141.5021	135.7439	120.5904	108.6914	102.5567	99.0228	103.0657	113.6208	124.6516	134.9335	142.6256	(72)
Total internal gains	591.6496	589.9520	571.6600	534.2153	496.2408	467.2331	450.1575	453.6187	476.7076	510.0296	546.3871	576.9521	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.4800	12.7650	0.6300	0.7000	0.7700	29.1807	(74)
East	4.3200	23.8018	0.6300	0.7000	0.7700	31.4242	(76)
South	12.8900	54.2217	0.6300	0.7000	0.7700	213.5984	(78)
East	4.0600	31.9987	0.6300	0.7000	1.0000	51.5631	(82)

Solar gains	325.7664	498.1412	709.8154	946.2107	1077.2611	1151.1353	1090.7626	991.3805	838.5099	600.7655	387.1509	278.5454	(83)
Total gains	917.4160	1088.0932	1281.4754	1480.4260	1573.5019	1618.3684	1540.9201	1444.9991	1315.2176	1110.7951	933.5379	855.4976	(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	26.2654	26.3535	26.3535	26.4788	26.4380	26.6327	26.6327	26.6688	26.6327	26.4788	26.5187	26.3962	
alpha	2.7510	2.7569	2.7569	2.7653	2.7625	2.7755	2.7755	2.7779	2.7755	2.7653	2.7679	2.7597	
util living area	0.9110	0.8666	0.7856	0.6558	0.5046	0.3352	0.2285	0.2499	0.4555	0.7073	0.8635	0.9225	(86)
Living	19.5053	19.7763	20.1571	20.5277	20.7539	20.8591	20.8823	20.8803	20.8134	20.5107	19.9628	19.4452	
Non living	18.0837	18.4154	18.8684	19.2914	19.5238	19.6217	19.6357	19.6365	19.5899	19.2889	18.6569	18.0145	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2354	19.7763	20.1571	20.5277	20.7539	20.8591	20.8823	20.8803	20.8134	20.5107	19.9628	19.6627	(87)
Th 2	19.7644	19.7680	19.7680	19.7730	19.7714	19.7792	19.7792	19.7806	19.7792	19.7730	19.7746	19.7697	(88)
util rest of house	0.8956	0.8450	0.7531	0.6085	0.4416	0.2609	0.1453	0.1621	0.3746	0.6531	0.8373	0.9087	(89)
MIT 2	19.0943	18.4154	18.8684	19.2914	19.5238	19.6217	19.6357	19.6365	19.5899	19.2889	18.6569	18.3308	(90)
Living area fraction									fLA = Living area / (4) =			0.3515	(91)
MIT	19.4955	18.8938	19.3214	19.7260	19.9562	20.0567	20.0739	20.0737	20.0200	19.7184	19.1159	18.7990	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4955	18.8938	19.3214	19.7260	19.9562	20.0567	20.0739	20.0737	20.0200	19.7184	19.1159	18.7990	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8917	0.8270	0.7399	0.6066	0.4515	0.2782	0.1656	0.1835	0.3912	0.6505	0.8207	0.8955	(94)
Useful gains	818.1040	899.8719	948.1151	897.9794	710.4133	450.1790	255.2343	265.1451	514.5208	722.5601	766.1085	766.0885	(95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	1578.5060	1441.9013	1302.8472	1068.7692	768.6855	460.3183	256.7152	267.1504	542.8692	893.9044	1207.2524	1494.6902	(97)
Space heating kWh	565.7391	364.2437	263.9207	122.9687	43.3546	0.0000	0.0000	0.0000	0.0000	127.4801	317.6236	542.0797	(98a)
Space heating requirement - total per year (kWh/year)												2347.4102	
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	565.7391	364.2437	263.9207	122.9687	43.3546	0.0000	0.0000	0.0000	0.0000	127.4801	317.6236	542.0797	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2347.4102	
Space heating per m ²										(98c) / (4) =		29.9415	(99)

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

Full SAP Calculation Printout



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 %)												350.4515 (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	565.7391	364.2437	263.9207	122.9687	43.3546	0.0000	0.0000	0.0000	0.0000	127.4801	317.6236	542.0797 (98)
Space heating efficiency (main heating system 1)	350.4515	350.4515	350.4515	350.4515	350.4515	0.0000	0.0000	0.0000	0.0000	350.4515	350.4515	350.4515 (210)
Space heating fuel (main heating system)	161.4315	103.9356	75.3088	35.0887	12.3711	0.0000	0.0000	0.0000	0.0000	36.3760	90.6327	154.6804 (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	244.1105	197.3272	166.9952	111.2115	78.2937	61.8244	61.3277	77.7897	112.3964	166.1577	212.4469	242.6526 (64)
Efficiency of water heater	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953	188.5953 (216)
Fuel for water heating, kWh/month	129.4362	104.6300	88.5469	58.9684	41.5142	32.7815	32.5181	41.2469	59.5966	88.1028	112.6470	128.6632 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	21.6424	17.3623	15.6329	11.4533	8.8469	7.2280	8.0704	10.4902	13.6258	17.8777	20.1928	22.2439 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.3101	-56.4357	-82.0523	-92.2364	-95.4344	-89.4159	-87.8489	-84.6720	-76.8682	-66.8990	-47.0862	-37.2737 (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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												669.8246 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												188.5953
Water heating fuel used												918.6516 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												174.6666 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-859.5327 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												983.6101 (238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	669.8246	18.3900	123.1807 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	918.6516	18.3900	168.9400 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	18.3900	14.7120 (249)
Energy for lighting	174.6666	18.3900	32.1212 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-859.5327	18.3900	-158.0681
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-158.0681 (252)
Total energy cost			180.8859 (255)

Full SAP Calculation Printout



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	669.8246	0.1567	104.9615 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	918.6516	0.1466	134.6964 (264)
Space and water heating			239.6579 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	174.6666	0.1443	25.2098 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-859.5327	0.1350	-116.0566
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-116.0566 (269)
Total CO2, kg/year			159.9081 (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	669.8246	1.5801	1058.3707 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	918.6516	1.5424	1416.9394 (278)
Space and water heating			2475.3101 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	174.6666	1.5338	267.9094 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-859.5327	1.4990	-1288.4776
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1288.4776 (283)
Total Primary energy kWh/year			1575.7658 (286)