

Full SAP Calculation Printout



Plot Reference	04			Issued on Date	05/08/2026
Assessment Reference	04 ashp + PV	Plot Type Ref			
Plot Address	Flat 4, 2-4 Church St, Caversham, Reading, RG4 8AT			SAP Version	10.2
SAP Rating	88 B	DER	2.97	TER	14.56
Environmental	98 A	% DER < TER			79.60
CO ₂ Emissions (t/year)	0.1	DFEE	35.29	TFEE	36.76
Compliance Check	See BREL	% DFEE < TFEE			3.99
% DPER < TPER	46.99	DPER	40.68	TPER	76.73
Assessor Details	Mrs. Nicola Battista			Assessor ID	L706-0001
Client	,				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	43.3700 (1b)	2.3900 (2b)	103.6543 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700		103.6543 (4)
Dwelling volume			103.6543 (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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1929 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4429 (18)
Number of sides sheltered	4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3101 (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)
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	0.3953	0.3876	0.3798	0.3411	0.3333	0.2946	0.2946	0.2868	0.3101	0.3333	0.3488	0.3643 (22b)
Effective ac	0.5781	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5608	0.5664 (25)

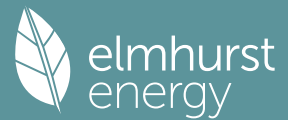
3. Heat losses and heat loss parameter

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
Main dwelling							
Opening Type 1			1.8900	1.4000	2.6460		(26)
Opening Type 2			3.6700	1.1450	4.2023		(27)
Opening Type 3			3.0400	1.1450	3.4809		(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1600	5.4416	60.0000	2040.6000 (29a)
External Wall 2	14.8600	1.8900	12.9700	0.1700	2.2049	190.0000	2464.3000 (29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116	9.0000	140.0400 (30)
External Roof 2	32.1900	3.0400	29.1500	0.1200	3.4980	9.0000	262.3500 (30)
Total net area of external elements A _{um} (A, m ²)			100.2900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 23.1853		(33)
Main dwelling							
Party Floor 1			43.3700			80.0000	3469.6000 (32d)
Internal Wall 1			56.1800			9.0000	505.6200 (32c)
Internal Wall 2			23.2300			100.0000	2323.0000 (32c)
Heat capacity C _m = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 11205.5100 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							258.3701 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				11.3000	0.0400	0.4520	
E2 Other lintels (including other steel lintels)				3.9600	0.0500	0.1980	

elmhurst
energy

6. Solar gains													
[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
West				3.6700	19.6403	0.6300	0.7000	0.7700	22.0285 (80)				
East				3.0400	26.0000	0.6300	0.7000	1.0000	31.3710 (82)				
Solar gains	53.3995	108.2476	186.7984	284.4877	358.5073	371.1634	351.6636	295.6208	221.2939	130.7668	67.2840	43.4533 (83)	

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Total gains 426.4541 488.0725 552.4227 637.3665 695.2323 696.5853 666.0350 611.1635 545.4527 465.4233 420.7806 409.7754 (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	62.8469	62.9788	63.1088	63.7262	63.8430	64.3928	64.3928	64.4956	64.1799	63.8430	63.6071	63.3622
alpha	5.1898	5.1986	5.2073	5.2484	5.2562	5.2929	5.2929	5.2997	5.2787	5.2562	5.2405	5.2241
util living area	0.9842	0.9680	0.9257	0.8066	0.6264	0.4407	0.3188	0.3622	0.5946	0.8739	0.9676	0.9868 (86)
Living	20.0176	20.2201	20.5082	20.8141	20.9567	20.9943	20.9992	20.9984	20.9751	20.7573	20.3400	19.9833
Non living	18.8581	19.1117	19.4621	19.8118	19.9499	19.9862	19.9887	19.9899	19.9719	19.7645	19.2715	18.8207
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	20.4974	20.2201	20.5082	20.8141	20.9567	20.9943	20.9992	20.9984	20.9751	20.7573	20.3400	20.1256 (87)
Th 2	19.9667	19.9686	19.9705	19.9795	19.9812	19.9890	19.9890	19.9904	19.9860	19.9812	19.9778	19.9742 (88)
util rest of house	0.9793	0.9587	0.9055	0.7643	0.5663	0.3727	0.2458	0.2833	0.5150	0.8327	0.9565	0.9828 (89)
MIT 2	19.5247	19.1117	19.4621	19.8118	19.9499	19.9862	19.9887	19.9899	19.9719	19.7645	19.2715	19.0286 (90)
Living area fraction									fLA = Living area / (4) =			0.5107 (91)
MIT	20.0215	19.6778	19.9964	20.3237	20.4641	20.5010	20.5048	20.5050	20.4842	20.2715	19.8172	19.5888 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0215	19.6778	19.9964	20.3237	20.4641	20.5010	20.5048	20.5050	20.4842	20.2715	19.8172	19.5888 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9796	0.9555	0.9060	0.7793	0.5953	0.4073	0.2831	0.3236	0.5549	0.8456	0.9544	0.9809 (94)
Useful gains	417.7658	466.3714	500.5226	496.7242	413.9050	283.7481	188.5799	197.7692	302.6901	393.5550	401.5825	401.9471 (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	778.6455	730.3713	665.6657	557.9773	427.2895	285.2468	188.7509	198.1114	309.6266	471.5318	622.3202	755.9691 (97)
Space heating kWh	268.4945	177.4080	122.8665	44.1023	9.9581	0.0000	0.0000	0.0000	0.0000	58.0147	158.9311	263.3923 (98a)
Space heating requirement - total per year (kWh/year)												1103.1675
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	268.4945	177.4080	122.8665	44.1023	9.9581	0.0000	0.0000	0.0000	0.0000	58.0147	158.9311	263.3923 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1103.1675
Space heating per m2										(98c) / (4) =		25.4362 (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 %)												212.4490 (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	268.4945	177.4080	122.8665	44.1023	9.9581	0.0000	0.0000	0.0000	0.0000	58.0147	158.9311	263.3923 (98)
Space heating efficiency (main heating system 1)	212.4490	212.4490	212.4490	212.4490	212.4490	0.0000	0.0000	0.0000	0.0000	212.4490	212.4490	212.4490 (210)
Space heating fuel (main heating system)	126.3807	83.5062	57.8334	20.7590	4.6873	0.0000	0.0000	0.0000	0.0000	27.3076	74.8091	123.9791 (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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Efficiency of water heater (217)m	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684 (216)
Fuel for water heating, kWh/month	120.2831	106.5535	113.5132	100.3972	97.7600	88.5536	87.6632	90.8368	91.5074	101.4978	107.2867	119.0339 (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	12.4452	9.9840	8.9895	6.5861	5.0873	4.1564	4.6408	6.0323	7.8353	10.2804	11.6117	12.7911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-23.8273	-35.3293	-52.9207	-60.7990	-66.9153	-62.9629	-62.1663	-57.7357	-49.6760	-40.4855	-26.5646	-20.3575 (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	-7.4767	-16.9081	-36.0457	-58.4335	-80.3864	-81.8582	-80.7409	-67.1230	-48.1134	-26.2931	-10.5665	-5.8387 (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												519.2623 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.7684
Water heating fuel used												1224.8864 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	100.4399 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1079.5246 (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	765.0640 (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	519.2623	0.1572	81.6154 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1224.8864	0.1407	172.3845 (264)
Space and water heating			253.9999 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	100.4399	0.1443	14.4966 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-559.7402	0.1340	-74.9789
PV Unit electricity exported	-519.7844	0.1241	-64.5006
Total			-139.4796 (269)
Total CO2, kg/year			129.0170 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9700 (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	519.2623	1.5818	821.3869 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1224.8864	1.5204	1862.2920 (278)
Space and water heating			2683.6789 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	100.4399	1.5338	154.0581 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-559.7402	1.4950	-836.8326
PV Unit electricity exported	-519.7844	0.4554	-236.7269
Total			-1073.5596 (283)
Total Primary energy kWh/year			1764.1774 (286)
Dwelling Primary energy Rate (DPER)			40.6800 (287)

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

1. Overall dwelling characteristics

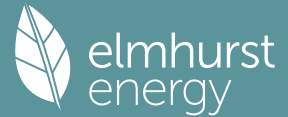
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	43.3700	2.3900	103.6543
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700		103.6543 (1b) - (3b)
Dwelling volume			103.6543 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1929 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4429 (18)
Number of sides sheltered	4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3101 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000

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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	0.3953	0.3876	0.3798	0.3411	0.3333	0.2946	0.2946	0.2868	0.3101	0.3333	0.3488	0.3643 (22b)
Effective ac	0.5781	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5608	0.5664 (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
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			3.6700	1.1450	4.2023		(27)
TER Roof Window			3.0400	1.1450	4.8390		(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1800	6.1218		(29a)
External Wall 2	14.8600	1.8900	12.9700	0.1800	2.3346		(29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116		(30)
External Roof 2	32.1900	3.0400	29.1500	0.1100	3.2065		(30)
Total net area of external elements Aum(A, m2)			100.2900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.3057	(33)

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

258.3701 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.3000	0.0900	1.0170
E2 Other lintels (including other steel lintels)	3.9600	0.0500	0.1980
E3 Sill	3.0600	0.0500	0.1530
E4 Jamb	11.4000	0.0500	0.5700
E7 Party floor between dwellings (in blocks of flats)	26.3100	0.0700	1.8417
R1 Head of roof window	3.2000	0.0800	0.2560
R2 Sill of roof window	3.2000	0.0600	0.1920
R3 Jamb of roof window	7.6000	0.0800	0.6080
E11 Eaves (insulation at rafter level)	14.1200	0.0400	0.5648
E10 Eaves (insulation at ceiling level)	6.3000	0.0600	0.3780
E12 Gable (insulation at ceiling level)	2.7600	0.0600	0.1656
E13 Gable (insulation at rafter level)	8.8800	0.0800	0.7104

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

6.6545 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 30.9602 (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	19.7759	19.6721	19.5704	19.0925	19.0031	18.5869	18.5869	18.5098	18.7472	19.0031	19.1840	19.3731 (38)
Heat transfer coeff	50.7362	50.6324	50.5306	50.0528	49.9634	49.5472	49.5472	49.4701	49.7075	49.9634	50.1442	50.3333 (39)
Average = Sum(39)m / 12 =												50.0523

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1698	1.1675	1.1651	1.1541	1.1520	1.1424	1.1424	1.1407	1.1461	1.1520	1.1562	1.1606 (40)
HLP (average)												1.1541
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

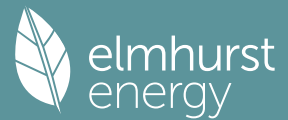
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.4985 (42)
Hot water usage for mixer showers	49.3445	48.6029	47.5223	45.4548	43.9290	42.2275	41.2604	42.3328	43.5083	45.3353	47.4472	49.1554 (42a)	
Hot water usage for baths	21.3430	21.0260	20.5796	19.7566	19.1403	18.4570	18.0879	18.5311	19.0138	19.7449	20.5849	21.2708 (42b)	
Hot water usage for other uses	29.9762	28.8862	27.7961	26.7061	25.6160	24.5260	24.5260	25.6160	26.7061	27.7961	28.8862	29.9762 (42c)	
Average daily hot water use (litres/day)												92.5333 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.6636	98.5151	95.8981	91.9175	88.6854	85.2105	83.8743	86.4800	89.2282	92.8763	96.9182	100.4024 (44)	
Energy conte	159.4266	140.2841	147.3917	125.8305	119.3876	104.7763	101.4387	107.0803	110.0273	126.0323	138.0778	157.2059 (45)	
Energy content (annual)										Total = Sum(45)m =		1536.9590	
Distribution loss (46)m = 0.15 x (45)m	23.9140	21.0426	22.1088	18.8746	17.9081	15.7164	15.2158	16.0620	16.5041	18.9048	20.7117	23.5809 (46)	
Water storage loss (or HIU loss):													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.7527 (55)	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (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	206.0215	182.3698	193.9866	170.9223	165.9825	149.8681	148.0336	153.6752	155.1191	172.6272	183.1697	203.8008 (62)	
WWHRS	-22.5582	-19.9507	-20.8912	-17.2987	-16.1218	-13.7955	-12.9311	-13.7510	-14.2734	-16.8268	-19.0627	-22.1405 (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	183.4632	162.4192	173.0954	153.6236	149.8607	136.0726	135.1024	139.9242	140.8457	155.8004	164.1070	181.6603 (64)	
										Total per year (kWh/year) = Sum(64)m =		1875.9748 (64)	
12Total per year (kWh/year)												1876 (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	90.2853	80.3130	86.2837	77.9121	76.9723	70.9116	71.0043	72.8801	72.6575	79.1817	81.9843	89.5469 (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
74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	67.7421	75.0002	67.7421	70.0002	67.7421	70.0002	67.7421	67.7421	70.0002	67.7421	70.0002	67.7421 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	130.0924	131.4424	128.0405	120.7984	111.6566	103.0645	97.3245	95.9745	99.3764	106.6185	115.7603	124.3524 (68)
Pumps, fans	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925 (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)	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Total internal gains	121.3512	119.5135	115.9727	108.2112	103.4574	98.4883	95.4359	97.9571	100.9132	106.4270	113.8671	120.3587 (72)
	367.6633	374.4337	360.2330	347.4875	331.3337	317.0306	305.9801	307.1514	315.7674	329.2652	348.1053	360.9309 (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	
West						3.6700	19.6403	0.6300	0.7000	0.7700	22.0285	(80)
East						3.0400	26.0000	0.6300	0.7000	1.0000	31.3710	(82)
Solar gains	53.3995	108.2476	186.7984	284.4877	358.5073	371.1634	351.6636	295.6208	221.2939	130.7668	67.2840	43.4533 (83)
Total gains	421.0628	482.6812	547.0314	631.9752	689.8411	688.1940	657.6437	602.7722	537.0614	460.0320	415.3893	404.3841 (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	61.3495	61.4753	61.5991	62.1872	62.2985	62.8218	62.8218	62.9197	62.6192	62.2985	62.0738	61.8406
alpha	5.0900	5.0984	5.1066	5.1458	5.1532	5.1881	5.1881	5.1946	5.1746	5.1532	5.1383	5.1227
util living area	0.9855	0.9706	0.9315	0.8190	0.6421	0.4563	0.3308	0.3760	0.6144	0.8839	0.9705	0.9879 (86)
MIT	19.9626	20.1678	20.4642	20.7881	20.9478	20.9925	20.9989	20.9978	20.9687	20.7280	20.2931	19.9278 (87)
Th 2	19.9442	19.9461	19.9480	19.9569	19.9586	19.9663	19.9663	19.9678	19.9633	19.9586	19.9552	19.9517 (88)
util rest of house	0.9810	0.9619	0.9123	0.7771	0.5804	0.3846	0.2535	0.2925	0.5319	0.8442	0.9601	0.9842 (89)
MIT 2	18.7721	19.0296	19.3918	19.7645	19.9207	19.9627	19.9660	19.9671	19.9455	19.7139	19.1966	18.7339 (90)
Living area fraction	19.3801	19.6109	19.9395	20.2873	20.4453	20.4887	20.4935	20.4935	20.4681	20.2318	19.7566	19.3437 (92)
MIT	19.3801	19.6109	19.9395	20.2873	20.4453	20.4887	20.4935	20.4935	20.4681	20.2318	19.7566	19.3437 (93)
Temperature adjustment												0.0000
adjusted MIT	19.3801	19.6109	19.9395	20.2873	20.4453	20.4887	20.4935	20.4935	20.4681	20.2318	19.7566	19.3437 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9779	0.9585	0.9121	0.7912	0.6099	0.4211	0.2930	0.3352	0.5731	0.8558	0.9577	0.9814 (94)
Ext temp.	411.7600	462.6562	498.9336	500.0133	420.7401	289.7975	192.6773	202.0409	307.7763	393.6731	397.8312	396.8469 (95)
Heat loss rate W	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)
Space heating kWh	765.1066	744.8471	679.1050	569.9646	436.9423	291.7661	192.9125	202.5069	316.5407	481.2390	634.6568	762.2323 (97)
Space heating requirement - total per year (kWh/year)	262.8899	189.6323	134.0475	50.3649	12.0545	0.0000	0.0000	0.0000	0.0000	65.1490	170.5144	271.8468 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	262.8899	189.6323	134.0475	50.3649	12.0545	0.0000	0.0000	0.0000	0.0000	65.1490	170.5144	271.8468 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1156.4993
Space heating per m2										(98c) / (4) =		26.6659 (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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	262.8899	189.6323	134.0475	50.3649	12.0545	0.0000	0.0000	0.0000	0.0000	65.1490	170.5144	271.8468 (98)
Space heating fuel (main heating system)	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 efficiency (main heating system 2)	284.8211	205.4521	145.2302	54.5665	13.0601	0.0000	0.0000	0.0000	0.0000	70.5840	184.7394	294.5252 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	183.4632	162.4192	173.0954	153.6236	149.8607	136.0726	135.1024	139.9242	140.8457	155.8004	164.1070	181.6603 (64)
Efficiency of water heater (217)m	84.8659	84.4081	83.4932	81.8481	80.4067	79.8000	79.8000	79.8000	79.8000	82.2582	84.1458	79.8000 (216)
Fuel for water heating, kWh/month	216.1801	192.4214	207.3169	187.6934	186.3784	170.5170	169.3013	175.3436	176.4984	189.4041	195.0269	213.8144 (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	14.0755	11.2919	10.1671	7.4488	5.7537	4.7008	5.2487	6.8225	8.8617	11.6271	13.1327	14.4667 (232)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.8221	-29.6347	-43.0230	-48.9153	-53.2666	-49.9752	-49.4235	-46.4364	-41.1920	-34.1966	-23.0154	-17.9747	(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	-10.9290	-23.0825	-46.0240	-69.3119	-91.7918	-92.2205	-91.0712	-76.9898	-56.3165	-32.9982	-14.5942	-8.6302	(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												1252.9786	(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												2279.8958	(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)												113.5972	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1071.8355	(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												2660.6361	(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	1252.9786	0.2100	263.1255	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2279.8958	0.2100	478.7781	(264)
Space and water heating			741.9036	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	113.5972	0.1443	16.3956	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-457.8756	0.1343	-61.5094	
PV Unit electricity exported	-613.9599	0.1258	-77.2569	
Total			-138.7664	(269)
Total CO2, kg/year			631.4621	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5600	(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	1252.9786	1.1300	1415.8658	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2279.8958	1.1300	2576.2823	(278)
Space and water heating			3992.1481	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	113.5972	1.5338	174.2391	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-457.8756	1.4965	-685.1974	
PV Unit electricity exported	-613.9599	0.4619	-283.5854	
Total			-968.7828	(283)
Total Primary energy kWh/year			3327.7053	(286)
Target Primary Energy Rate (TPER)			76.7300	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	43.3700	2.3900	103.6543	(1b) - (3b)
Ground floor				(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700			(5)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	103.6543	

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000	Air changes per hour	
Pressure test		/ (5) =	0.1929	(8)
Pressure Test Method			Yes	
Measured/design AP50			Blower Door	
Infiltration rate			5.0000	(17)
Number of sides sheltered			0.4429	(18)
			4	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3101	(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												
	0.3953	0.3876	0.3798	0.3411	0.3333	0.2946	0.2946	0.2868	0.3101	0.3333	0.3488	0.3643 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5781	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5608	0.5664 (25)

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	
Main dwelling								
Opening Type 1			1.8900	1.4000	2.6460			(26)
Opening Type 2			3.6700	1.1450	4.2023			(27)
Opening Type 3			3.0400	1.1450	3.4809			(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1600	5.4416	60.0000	2040.6000	(29a)
External Wall 2	14.8600	1.8900	12.9700	0.1700	2.2049	190.0000	2464.3000	(29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116	9.0000	140.0400	(30)
External Roof 2	32.1900	3.0400	29.1500	0.1200	3.4980	9.0000	262.3500	(30)
Total net area of external elements Aum (A, m2)			100.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1853			(33)
Main dwelling								
Party Floor 1			43.3700			80.0000	3469.6000	(32d)
Internal Wall 1			56.1800			9.0000	505.6200	(32c)
Internal Wall 2			23.2300			100.0000	2323.0000	(32e)

List of Thermal Bridges

List of Thermal Bridges

Item	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	11.3000	0.0400	0.4520
E2 Other lintels (including other steel lintels)	3.9600	0.0500	0.1980
E3 Sill	3.0600	0.0240	0.0734
E4 Jamb	11.4000	0.0190	0.2166
E7 Party floor between dwellings (in blocks of flats)	26.3100	0.0320	0.8419
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	7.6000	0.2400	1.8240
E11 Eaves (insulation at rafter level)	14.1200	0.0200	0.2824
E10 Eaves (insulation at ceiling level)	6.3000	0.0840	0.5292
E12 Gable (insulation at ceiling level)	2.7600	0.0450	0.1242
E13 Gable (insulation at rafter level)	8.8800	0.0550	0.4884

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

Point Thermal bridges

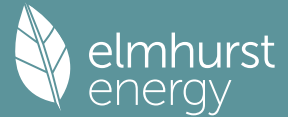
Point thermal bridges	(35a)	=	0.0000
Total fabric heat loss	(33) + (36) +	=	29.7515 (37)

[illegible]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1420	1.1396	1.1372	1.1262	1.1242	1.1146	1.1146	1.1128	1.1183	1.1242	1.1283	1.1327 (40)
HLP (average)												1.1262
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

[illegible]

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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												
	69.0855	60.4131	63.1990	54.0643	51.2131	44.9247	43.8071	46.4639	47.9205	54.8359	59.9085	68.2044 (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	69.0855	60.4131	63.1990	54.0643	51.2131	44.9247	43.8071	46.4639	47.9205	54.8359	59.9085	68.2044 (64)
								Total per year (kWh/year) =	Sum (64)m =			664.0400 (64)
12Total per year (kWh/year)												664 (64)
Electric shower(s)	39.5167	35.2097	38.4476	36.6901	37.3786	35.6555	36.8441	37.3786	36.6901	38.4476	37.7247	39.5167 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) =	Sum (64a)m =			449.5000 (64a)
Heat gains from water heating, kWh/month	27.1505	23.9057	25.4116	22.6886	22.1479	20.1451	20.1628	20.9606	21.1527	23.3209	24.4083	26.9303 (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	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	67.7421	75.0002	67.7421	70.0002	67.7421	70.0002	67.7421	67.7421	70.0002	67.7421	70.0002	67.7421 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	130.0924	131.4424	128.0405	120.7984	111.6566	103.0645	97.3245	95.9745	99.3764	106.6185	115.7603	124.3524 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925 (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)												
	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Water heating gains (Table 5)												
	36.4927	35.5740	34.1554	31.5120	29.7687	27.9793	27.1005	28.1729	29.3787	31.3453	33.9004	36.1966 (72)
Total internal gains	279.8048	287.4942	275.4157	267.7882	254.6450	246.5216	237.6448	237.3672	244.2329	251.1835	265.1386	273.7687 (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
West					3.6700	19.6403	0.6300	0.7000			0.7700	22.0285 (80)
East					3.0400	26.0000	0.6300	0.7000			1.0000	31.3710 (82)
Solar gains	53.3995	108.2476	186.7984	284.4877	358.5073	371.1634	351.6636	295.6208	221.2939	130.7668	67.2840	43.4533 (83)
Total gains	333.2043	395.7417	462.2141	552.2759	613.1524	617.6850	589.3084	532.9880	465.5268	381.9503	332.4225	317.2220 (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	62.8469	62.9788	63.1088	63.7262	63.8430	64.3928	64.3928	64.4956	64.1799	63.8430	63.6071	63.3622
alpha	5.1898	5.1986	5.2073	5.2484	5.2562	5.2929	5.2929	5.2997	5.2787	5.2562	5.2405	5.2241
util living area	0.9946	0.9865	0.9610	0.8670	0.6930	0.4943	0.3599	0.4142	0.6784	0.9330	0.9879	0.9958 (86)
MIT	19.8047	20.0222	20.3460	20.7287	20.9311	20.9902	20.9985	20.9970	20.9544	20.6354	20.1496	19.7696 (87)
Th 2	19.9667	19.9686	19.9705	19.9795	19.9812	19.9890	19.9890	19.9904	19.9860	19.9812	19.9778	19.9742 (88)
util rest of house												
	0.9929	0.9821	0.9486	0.8313	0.6315	0.4192	0.2778	0.3245	0.5944	0.9054	0.9831	0.9944 (89)
MIT 2	18.8934	19.1096	19.4253	19.7811	19.9411	19.9852	19.9886	19.9897	19.9647	19.7113	19.2445	18.8645 (90)
Living area fraction												
									fLA = Living area / (4) =			0.5107 (91)
MIT	19.3588	19.5757	19.8955	20.2650	20.4467	20.4985	20.5044	20.5041	20.4702	20.1833	19.7067	19.3268 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3588	19.5757	19.8955	20.2650	20.4467	20.4985	20.5044	20.5041	20.4702	20.1833	19.7067	19.3268 (93)

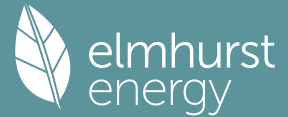
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9915	0.9801	0.9475	0.8421	0.6605	0.4574	0.3197	0.3704	0.6359	0.9117	0.9816	0.9933 (94)
Useful gains	330.3693	387.8483	437.9657	465.0741	404.9752	282.5377	188.4223	197.4131	296.0276	348.2202	326.2914	315.0815 (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	745.8240	725.3264	660.6905	555.1145	426.4427	285.1230	188.7322	198.0700	308.9447	467.2290	616.9159	743.0951 (97)
Space heating kWh	309.0983	226.7852	165.7072	64.8291	15.9718	0.0000	0.0000	0.0000	0.0000	88.5426	209.2497	318.4421 (98a)
Space heating requirement - total per year (kWh/year)												1398.6261
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	309.0983	226.7852	165.7072	64.8291	15.9718	0.0000	0.0000	0.0000	0.0000	88.5426	209.2497	318.4421 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1398.6261
Space heating per m ²										(98c) / (4) =		32.2487 (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	454.3808	357.7041	366.7860	0.0000	0.0000	0.0000	0.0000 (100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9512	0.9773	0.9629	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	432.2197	349.5763	353.1898	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	656.2795	626.7598	568.7517	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	161.3231	206.2246	160.3780	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)									fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	40.3308	51.5561	40.0945	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												131.9814 (107)
Energy for space cooling												32.2487 (99)
Total												3.0432 (108)
Fabric Energy Efficiency (DFEE)												35.2918 (109)
												35.3 (109)

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

1. Overall dwelling characteristics

Main dwelling		Area (m2)	Storey height (m)	Volume (m3)	
Ground floor		43.3700 (1b)	x 2.3900 (2b)	= 103.6543 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	43.3700			(4)	
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	103.6543 (5)	

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1929 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000	(17)	
Infiltration rate	0.4429	(18)	
Number of sides sheltered	4	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3101 (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	0.3953	0.3876	0.3798	0.3411	0.3333	0.2946	0.2946	0.2868	0.3101	0.3333	0.3488	0.3643 (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	0.5781	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5608	0.5664 (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
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			3.6700	1.1450	4.2023		(27)
TER Roof Window			3.0400	1.1450	4.8390		(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1800	6.1218		(29a)
External Wall 2	14.8600	1.8900	12.9700	0.1800	2.3346		(29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116		(30)
External Roof 2	32.1900	3.0400	29.1500	0.1100	3.2065		(30)
Total net area of external elements Aum(A, m2)			100.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3057		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							258.3701 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				11.3000	0.0900	1.0170	
E2 Other lintels (including other steel lintels)				3.9600	0.0500	0.1980	
E3 Sill				3.0600	0.0500	0.1530	
E4 Jamb				11.4000	0.0500	0.5700	
E7 Party floor between dwellings (in blocks of flats)				26.3100	0.0700	1.8417	
R1 Head of roof window				3.2000	0.0800	0.2560	
R2 Sill of roof window				3.2000	0.0600	0.1920	
R3 Jamb of roof window				7.6000	0.0800	0.6080	
E11 Eaves (insulation at rafter level)				14.1200	0.0400	0.5648	
E10 Eaves (insulation at ceiling level)				6.3000	0.0600	0.3780	
E12 Gable (insulation at ceiling level)				2.7600	0.0600	0.1656	
E13 Gable (insulation at rafter level)				8.8800	0.0800	0.7104	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6545 (36)

$$\begin{aligned} (33) + (36) + (36a) &= 30.9602 \quad (37) \end{aligned}$$
[illegible]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1698	1.1675	1.1651	1.1541	1.1520	1.1424	1.1424	1.1407	1.1461	1.1520	1.1562	1.1606 (40)
HLP (average)												1.1541
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												1.4985 (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	21.3430	21.0260	20.5796	19.7566	19.1403	18.4570	18.0879	18.5311	19.0138	19.7449	20.5849	21.2708 (42b)
Hot water usage for other uses	29.9762	28.8862	27.7961	26.7061	25.6160	24.5260	24.5260	25.6160	26.7061	27.7961	28.8862	29.9762 (42c)
Average daily hot water use (litres/day)												47.0394 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	51.3192	49.9121	48.3757	46.4627	44.7564	42.9830	42.6139	44.1472	45.7198	47.5411	49.4711	51.2470 (44)
Energy content (annual)	81.2770	77.10742	74.3517	63.6051	60.2507	52.8526	51.5378	54.6634	56.3771	64.5128	70.4806	80.2404 (45)
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	781.2235
Water storage loss (or HIU 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 (46)
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	69.0855	60.4131	63.1990	54.0643	51.2131	44.9247	43.8071	46.4639	47.9205	54.8359	59.9085	68.2044 (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	69.0855	60.4131	63.1990	54.0643	51.2131	44.9247	43.8071	46.4639	47.9205	54.8359	59.9085	68.2044 (64)
12Total per year (kWh/year)										Total per year (kWh/year) =	Sum(64)m =	664.0400 (64)
Electric shower(s)	39.5167	35.2097	38.4476	36.6901	37.3786	35.6555	36.8441	37.3786	36.6901	38.4476	37.7247	39.5167 (64a)
												449.5000 (64a)
Heat gains from water heating, kWh/month	27.1505	23.9057	25.4116	22.6886	22.1479	20.1451	20.1628	20.9606	21.1527	23.3209	24.4083	26.9303 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253	74.9253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.7421	75.0002	67.7421	70.0002	67.7421	70.0002	67.7421	67.7421	70.0002	67.7421	70.0002	67.7421 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	130.0924	131.4424	128.0405	120.7984	111.6566	103.0645	97.3245	95.9745	99.3764	106.6185	115.7603	124.3524 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925	30.4925 (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)	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Water heating gains (Table 5)	36.4927	35.5740	34.1554	31.5120	29.7687	27.9793	27.1005	28.1729	29.3787	31.3453	33.9004	36.1966 (72)
Total internal gains	279.8048	287.4942	275.4157	267.7882	254.6450	246.5216	237.6448	237.3672	244.2329	251.1835	265.1386	273.7687 (73)

[Jan					Area	Solar flux	g	FF			Access	Gains
					m2	Table 6a	Specific data	Specific data			factor	W
						W/m2	or Table 6b	or Table 6c			Table 6d	
West					3.6700	19.6403	0.6300	0.7000			0.7700	22.0285 (80)
East					3.0400	26.0000	0.6300	0.7000			1.0000	31.3710 (82)

Solar gains	53.3995	108.2476	186.7984	284.4877	358.5073	371.1634	351.6636	295.6208	221.2939	130.7668	67.2840	43.4533 (83)
Total gains	333.2043	395.7417	462.2141	552.2759	613.1524	617.6850	589.3084	532.9880	465.5268	381.9503	332.4225	317.2220 (84)

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	61.3495	61.4753	61.5991	62.1872	62.2985	62.8218	62.8218	62.9197	62.6192	62.2985	62.0738	61.8406
alpha	5.0900	5.0984	5.1066	5.1458	5.1532	5.1881	5.1881	5.1946	5.1746	5.1532	5.1383	5.1227
util living area	0.9947	0.9869	0.9626	0.8733	0.7041	0.5054	0.3686	0.4240	0.6897	0.9362	0.9882	0.9959 (86)

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MIT	19.7622	19.9807	20.3090	20.7033	20.9207	20.9881	20.9981	20.9962	20.9472	20.6099	20.1137	19.7269 (87)
Th 2	19.9442	19.9461	19.9480	19.9569	19.9586	19.9663	19.9663	19.9678	19.9633	19.9586	19.9552	19.9517 (88)
util rest of house	0.9930	0.9826	0.9506	0.8382	0.6416	0.4273	0.2827	0.3304	0.6041	0.9093	0.9836	0.9945 (89)
MIT 2	18.8336	19.0509	19.3713	19.7391	19.9123	19.9617	19.9659	19.9669	19.9387	19.6691	19.1912	18.8044 (90)
Living area fraction	19.3078	19.5257	19.8502	20.2315	20.4273	20.4859	20.4931	20.4926	20.4538	20.1496	19.6623	19.2755 (92)
Temperature adjustment	19.3078	19.5257	19.8502	20.2315	20.4273	20.4859	20.4931	20.4926	20.4538	20.1496	19.6623	19.2755 (93)
adjusted MIT												

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9805	0.9493	0.8482	0.6707	0.4670	0.3266	0.3783	0.6462	0.9150	0.9819	0.9933	(94)
Useful gains	330.3945	388.0219	438.7787	468.4527	411.2602	288.4637	192.4952	201.6350	300.8215	349.4850	326.4220	315.0937	(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	761.4408	740.5363	674.5936	567.1728	436.0474	291.6300	192.8907	202.4595	315.8300	477.1291	629.9271	758.8019	(97)
Space heating kWh	320.6985	236.8896	175.4462	71.0785	18.4417	0.0000	0.0000	0.0000	0.0000	94.9672	218.5236	330.1189	(98a)
Space heating requirement - total per year (kWh/year)												1466.1643	
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	320.6985	236.8896	175.4462	71.0785	18.4417	0.0000	0.0000	0.0000	0.0000	94.9672	218.5236	330.1189	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1466.1643	
Space heating per m2												(98c) / (4) =	33.8060 (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	465.7433	366.6490	375.9726	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9443	0.9733	0.9572	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	439.8191	356.8704	359.8935	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	656.2795	626.7598	568.7517	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	155.8515	200.7978	155.3905	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction	fc = cooled area / (4) =												1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.9629	50.1994	38.8476	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													128.0099 (107)
Energy for space heating													33.8060 (99)
Energy for space cooling													2.9516 (108)
Total													36.7575 (109)
Fabric Energy Efficiency (TFEE)													36.8 (109)

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

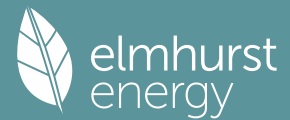
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	43.3700 (1b)	x 2.3900 (2b)	= 103.6543 (1b) - (3b)	
Ground floor				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	103.6543 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1929 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4429 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3101 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.3953	0.3876	0.3798	0.3411	0.3333	0.2946	0.2946	0.2868	0.3101	0.3333	0.3488	0.3643	(22b)
	0.5781	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5608	0.5664	(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
Main dwelling							
Opening Type 1			1.8900	1.4000	2.6460		(26)
Opening Type 2			3.6700	1.1450	4.2023		(27)
Opening Type 3			3.0400	1.1450	3.4809		(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1600	5.4416	60.0000	2040.6000 (29a)
External Wall 2	14.8600	1.8900	12.9700	0.1700	2.2049	190.0000	2464.3000 (29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116	9.0000	140.0400 (30)
External Roof 2	32.1900	3.0400	29.1500	0.1200	3.4980	9.0000	262.3500 (30)
Total net area of external elements Aum(A, m2)			100.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1853		(33)
Main dwelling							
Party Floor 1			43.3700			80.0000	3469.6000 (32d)
Internal Wall 1			56.1800			9.0000	505.6200 (32c)
Internal Wall 2			23.2300			100.0000	2323.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11205.5100 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 258.3701 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.3000	0.0400	0.4520
E2 Other lintels (including other steel lintels)	3.9600	0.0500	0.1980
E3 Sill	3.0600	0.0240	0.0734
E4 Jamb	11.4000	0.0190	0.2166
E7 Party floor between dwellings (in blocks of flats)	26.3100	0.0320	0.8419
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	7.6000	0.2400	1.8240
E11 Eaves (insulation at rafter level)	14.1200	0.0200	0.2824
E10 Eaves (insulation at ceiling level)	6.3000	0.0840	0.5292
E12 Gable (insulation at ceiling level)	2.7600	0.0450	0.1242
E13 Gable (insulation at rafter level)	8.8800	0.0550	0.4884

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.5662 (36)

Point Thermal Bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 29.7515 (37)

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

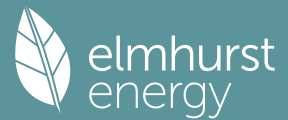
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	19.7759	19.6721	19.5704	19.0925	19.0031	18.5869	18.5869	18.5098	18.7472	19.0031	19.1840	19.3731	(38)
Average = Sum(39)m / 12 =	49.5274	49.4236	49.3219	48.8440	48.7546	48.3384	48.3384	48.2613	48.4987	48.7546	48.9355	49.1246	(39)
												48.8436	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1420	1.1396	1.1372	1.1262	1.1242	1.1146	1.1146	1.1128	1.1183	1.1242	1.1283	1.1327	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.4985 (42)
Hot water usage for mixer showers	49.3445	48.6029	47.5223	45.4548	43.9290	42.2275	41.2604	42.3328	43.5083	45.3353	47.4472	49.1554	(42a)
Hot water usage for baths	21.3430	21.0260	20.5796	19.7566	19.1403	18.4570	18.0879	18.5311	19.0138	19.7449	20.5849	21.2708	(42b)
Hot water usage for other uses	29.9762	28.8862	27.7961	26.7061	25.6160	24.5260	24.5260	25.6160	26.7061	27.7961	28.8862	29.9762	(42c)
Average daily hot water use (litres/day)													92.5333 (43)
Daily hot water use	100.6636	98.5151	95.8981	91.9175	88.6854	85.2105	83.8743	86.4800	89.2282	92.8763	96.9182	100.4024	(44)
Energy conte	159.4266	140.2841	147.3917	125.8305	119.3876	104.7763	101.4387	107.0803	110.0273	126.0323	138.0778	157.2059	(45)
Energy content (annual)										Total = Sum(45)m =		1536.9590	
Distribution loss (46)m = 0.15 x (45)m	23.9140	21.0426	22.1088	18.8746	17.9081	15.7164	15.2158	16.0620	16.5041	18.9048	20.7117	23.5809	(46)
Water storage loss (or HIU 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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047	(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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047	(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	96.5284	85.9520	92.5268	83.9538	83.2154	76.9533	77.2474	79.1232	78.6993	85.4248	88.0261	95.7900	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.2183	12.6286	10.2702	7.7752	5.8121	4.9068	5.3020	6.8917	9.2500	11.7450	13.7082	14.6135 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.1678	196.1827	191.1053	180.2962	166.6516	153.8276	145.2604	143.2456	148.3230	159.1321	172.7766	185.6006 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895 (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)	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Water heating gains (Table 5)	129.7424	127.9047	124.3640	116.6025	111.8487	106.8796	103.8271	106.3484	109.3045	114.8183	122.2584	128.7500 (72)
Total internal gains	413.5882	412.1757	401.1992	380.1336	359.7721	341.0737	329.8492	331.9454	342.3372	361.1550	384.2029	404.4238 (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	
West	3.6700		19.6403		0.6300		0.7000		0.7700		22.0285 (80)	
East	3.0400		26.0000		0.6300		0.7000		1.0000		31.3710 (82)	
Solar gains	53.3995	108.2476	186.7984	284.4877	358.5073	371.1634	351.6636	295.6208	221.2939	130.7668	67.2840	43.4533 (83)
Total gains	466.9877	520.4232	587.9976	664.6213	718.2794	712.2371	681.5129	627.5662	563.6311	491.9219	451.4869	447.8770 (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	62.8469	62.9788	63.1088	63.7262	63.8430	64.3928	64.3928	64.4956	64.1799	63.8430	63.6071	63.3622
alpha	5.1898	5.1986	5.2073	5.2484	5.2562	5.2929	5.2929	5.2997	5.2787	5.2562	5.2405	5.2241
util living area	0.9769	0.9590	0.9088	0.7869	0.6093	0.4314	0.3116	0.3528	0.5777	0.8526	0.9574	0.9808 (86)
Living	20.1056	20.2844	20.5637	20.8355	20.9618	20.9948	20.9993	20.9986	20.9782	20.7880	20.4007	20.0676
Non living	18.9676	19.1898	19.5254	19.8328	19.9538	19.9865	19.9888	19.9900	19.9737	19.7953	19.3445	18.9261
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	20.5425	20.2844	20.5637	20.8355	20.9618	20.9948	20.9993	20.9986	20.9782	20.7880	20.4007	20.1981 (87)
Th 2	19.9667	19.9686	19.9705	19.9795	19.9812	19.9890	19.9890	19.9904	19.9860	19.9812	19.9778	19.9742 (88)
util rest of house	0.9702	0.9476	0.8855	0.7431	0.5498	0.3646	0.2403	0.2759	0.4995	0.8081	0.9436	0.9751 (89)
MIT 2	19.5684	19.1898	19.5254	19.8328	19.9538	19.9865	19.9888	19.9900	19.9737	19.7953	19.3445	19.1150 (90)
Living area fraction									fLA = Living area / (4) =			0.5107 (91)
MIT	20.0659	19.7488	20.0557	20.3449	20.4686	20.5015	20.5048	20.5051	20.4867	20.3023	19.8839	19.6681 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0659	19.7488	20.0557	20.3449	20.4686	20.5015	20.5048	20.5051	20.4867	20.3023	19.8839	19.6681 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9709	0.9447	0.8876	0.7595	0.5788	0.3986	0.2767	0.3152	0.5388	0.8233	0.9421	0.9731 (94)
Useful gains	453.3978	491.6513	521.9148	504.8107	415.7359	283.9143	188.6009	197.8164	303.6867	404.9818	425.3240	435.8073 (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	780.8432	733.8821	668.5910	559.0146	427.5114	285.2669	188.7536	198.1175	309.7471	473.0321	625.5861	759.8648 (97)
Space heating kWh	243.6194	162.7791	109.1271	39.0268	8.7610	0.0000	0.0000	0.0000	0.0000	50.6294	144.1887	241.0987 (98a)
Space heating requirement - total per year (kWh/year)												999.2302
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	243.6194	162.7791	109.1271	39.0268	8.7610	0.0000	0.0000	0.0000	0.0000	50.6294	144.1887	241.0987 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												999.2302
Space heating per m ²										(98c) / (4) =		23.0397 (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 %)												212.4490 (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	243.6194	162.7791	109.1271	39.0268	8.7610	0.0000	0.0000	0.0000	0.0000	50.6294	144.1887	241.0987 (98)
Space heating efficiency (main heating system 1)	212.4490	212.4490	212.4490	212.4490	212.4490	0.0000	0.0000	0.0000	0.0000	212.4490	212.4490	212.4490 (210)
Space heating fuel (main heating system)	114.6719	76.6203	51.3663	18.3700	4.1238	0.0000	0.0000	0.0000	0.0000	23.8313	67.8698	113.4855 (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)

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Water heating												
Water heating requirement												
	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Efficiency of water heater												177.7684 (216)
(217)m	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684 (217)
Fuel for water heating, kWh/month												
	120.2831	106.5535	113.5132	100.3972	97.7600	88.5536	87.6632	90.8368	91.5074	101.4978	107.2867	119.0339 (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	12.4452	9.9840	8.9895	6.5861	5.0873	4.1564	4.6408	6.0323	7.8353	10.2804	11.6117	12.7911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-23.7326	-35.1868	-52.6485	-60.6145	-66.8536	-62.9629	-62.1663	-57.7357	-49.6760	-40.3525	-26.4685	-20.2890 (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	-7.5714	-17.0506	-36.3179	-58.6180	-80.4481	-81.8582	-80.7409	-67.1230	-48.1134	-26.4261	-10.6626	-5.9072 (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												470.3389 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.7684
Water heating fuel used												1224.8864 (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)												100.4399 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1079.5246 (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												716.1406 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	470.3389	16.4900	77.5589 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1224.8864	16.4900	201.9838 (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	100.4399	16.4900	16.5625 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-558.6870	16.4900	-92.1275
PV Unit electricity exported	-520.8376	5.5900	-29.1148
Total			-121.2423 (252)
Total energy cost			174.8629 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)			0.7124 (257)
SAP value			88.4528
SAP rating (Section 12)			88 (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	470.3389	0.1573	73.9686 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1224.8864	0.1407	172.3845 (264)
Space and water heating			246.3531 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	100.4399	0.1443	14.4966 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-558.6870	0.1339	-74.8208
PV Unit electricity exported	-520.8376	0.1242	-64.6782
Total			-139.4989 (269)
Total CO2, kg/year			121.3508 (272)
CO2 emissions per m2			2.8000 (273)
EI value			98.1599
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3700 (1b)	x 2.3900 (2b)	= 103.6543 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 103.6543 (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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1929 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4429 (18)
Number of sides sheltered	4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3101 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3566	0.3411	0.3411	0.3178	0.3178	0.2868	0.2868	0.2713	0.2946	0.3256	0.3101	0.3333 (22b)
Effective ac	0.5636	0.5582	0.5582	0.5505	0.5505	0.5411	0.5411	0.5368	0.5434	0.5530	0.5481	0.5556 (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
Main dwelling							
Opening Type 1			1.8900	1.4000	2.6460		(26)
Opening Type 2			3.6700	1.1450	4.2023		(27)
Opening Type 3			3.0400	1.1450	3.4809		(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1600	5.4416	60.0000	2040.6000 (29a)
External Wall 2	14.8600	1.8900	12.9700	0.1700	2.2049	190.0000	2464.3000 (29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116	9.0000	140.0400 (30)
External Roof 2	32.1900	3.0400	29.1500	0.1200	3.4980	9.0000	262.3500 (30)
Total net area of external elements Aum(A, m ²)			100.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1853		(33)
Main dwelling							
Party Floor 1			43.3700			80.0000	3469.6000 (32d)
Internal Wall 1			56.1800			9.0000	505.6200 (32c)
Internal Wall 2			23.2300			100.0000	2323.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 11205.5100 (34)
258.3701 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.3000	0.0400	0.4520
E2 Other lintels (including other steel lintels)	3.9600	0.0500	0.1980
E3 Sill	3.0600	0.0240	0.0734
E4 Jamb	11.4000	0.0190	0.2166
E7 Party floor between dwellings (in blocks of flats)	26.3100	0.0320	0.8419
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	7.6000	0.2400	1.8240
E11 Eaves (insulation at rafter level)	14.1200	0.0200	0.2824
E10 Eaves (insulation at ceiling level)	6.3000	0.0840	0.5292
E12 Gable (insulation at ceiling level)	2.7600	0.0450	0.1242
E13 Gable (insulation at rafter level)	8.8800	0.0550	0.4884

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

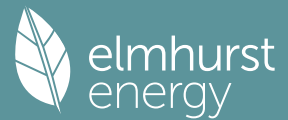
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.7515 (37)

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	19.2775	19.0925	19.0925	18.8305	18.8305	18.5098	18.5098	18.3619	18.5869	18.9158	18.7472	19.0031 (38)
Heat transfer coeff	49.0290	48.8440	48.8440	48.5819	48.5819	48.2613	48.2613	48.1133	48.3384	48.6672	48.4987	48.7546 (39)
Average = Sum(39)m / 12 =												48.5646

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1305	1.1262	1.1262	1.1202	1.1202	1.1128	1.1128	1.1094	1.1146	1.1221	1.1183	1.1242 (40)
HLP (average)												1.1198
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.4985 (42)
Hot water usage for mixer showers												49.1554 (42a)
Hot water usage for baths												21.2708 (42b)
Hot water usage for other uses												29.9762 (42c)
Average daily hot water use (litres/day)												92.5333 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	100.6636	98.5151	95.8981	91.9175	88.6854	85.2105	83.8743	86.4800	89.2282	92.8763	96.9182	100.4024 (44)
Distribution loss (46)m = 0.15 x (45)m	159.4266	140.2841	147.3917	125.8305	119.3876	104.7763	101.4387	107.0803	110.0273	126.0323	138.0778	157.2059 (45)
Water storage loss (or HIU loss):	23.9140	21.0426	22.1088	18.8746	17.9081	15.7164	15.2158	16.0620	16.5041	18.9048	20.7117	23.5809 (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 (56)
If cylinder contains dedicated solar storage												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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	96.5284	85.9520	92.5268	83.9538	83.2154	76.9533	77.2474	79.1232	78.6993	85.4248	88.0261	95.7900 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

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	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.2183	12.6286	10.2702	7.7752	5.8121	4.9088	5.3020	6.8917	9.2500	11.7450	13.7082	14.6135 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.1678	196.1827	191.1053	180.2962	166.6516	153.8276	145.2604	143.2456	148.3230	159.1321	172.7766	185.6006 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895 (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)	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Water heating gains (Table 5)	129.7424	127.9047	124.3640	116.6025	111.8487	106.8796	103.8271	106.3484	109.3045	114.8183	122.2584	128.7500 (72)
Total internal gains	413.5882	412.1757	401.1992	380.1336	359.7721	341.0737	329.8492	331.9454	342.3372	361.1550	384.2029	404.4238 (73)

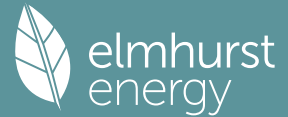
6. Solar gains

[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			
West				3.6700	23.8018	0.6300	0.7000	0.7700	26.6961 (80)			
East				3.0400	32.0000	0.6300	0.7000	1.0000	38.6104 (82)			
Solar gains	65.3065	115.5960	195.5759	304.1943	370.4810	405.3841	380.3921	328.3855	247.1369	147.7913	79.0265	53.4510 (83)
Total gains	478.8947	527.7716	596.7751	684.3279	730.2530	746.4578	710.2413	660.3309	589.4741	508.9463	463.2294	457.8747 (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	63.4857	63.7262	63.7262	64.0699	64.0699	64.4956	64.4956	64.6940	64.3928	63.9576	64.1799	63.8430
alpha	5.2324	5.2484	5.2484	5.2713	5.2713	5.2997	5.2997	5.3129	5.2929	5.2638	5.2787	5.2562
util living area	0.9713	0.9514	0.8913	0.7449	0.5588	0.3610	0.2513	0.2767	0.5165	0.8165	0.9454	0.9759 (86)
Living	20.1929	20.3599	20.6326	20.8816	20.9765	20.9981	20.9998	20.9997	20.9881	20.8396	20.4867	20.1585
Non living	19.0837	19.2908	19.6126	19.8832	19.9688	19.9896	19.9904	19.9931	19.9829	19.8491	19.4549	19.0453
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	20.5871	20.3599	20.6326	20.8816	20.9765	20.9981	20.9998	20.9997	20.9881	20.8396	20.4867	20.2762 (87)
Th 2	19.9760	19.9795	19.9795	19.9844	19.9844	19.9904	19.9904	19.9932	19.9890	19.9828	19.9860	19.9812 (88)
util rest of house	0.9630	0.9380	0.8642	0.6967	0.4977	0.2965	0.1828	0.2035	0.4386	0.7648	0.9278	0.9687 (89)
MIT 2	19.6203	19.2908	19.6126	19.8832	19.9688	19.9896	19.9904	19.9931	19.9829	19.8491	19.4549	19.2139 (90)
Living area fraction	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (91)
MIT	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (92)
Temperature adjustment	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (93)
adjusted MIT	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9643	0.9358	0.8687	0.7168	0.5281	0.3294	0.2178	0.2409	0.4781	0.7850	0.9278	0.9668	(94)
Useful gains	461.7762	493.9108	518.4146	490.5558	385.6656	245.8940	154.6833	159.0564	281.8388	399.4991	429.7633	442.6684	(95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000	(96)
Heat loss rate W	755.7361	710.0351	641.4957	529.2080	392.7091	246.3580	154.7209	159.1193	285.0160	450.4140	600.5055	734.0712	(97)
Space heating kWh	218.7061	145.2355	91.5723	27.8295	5.2404	0.0000	0.0000	0.0000	0.0000	37.8806	122.9344	216.8037	(98a)
Space heating requirement - total per year (kWh/year)												866.2025	
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	218.7061	145.2355	91.5723	27.8295	5.2404	0.0000	0.0000	0.0000	0.0000	37.8806	122.9344	216.8037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												866.2025	
Space heating per m2										(98c) / (4) =		19.9724	(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 %)													212.3111	(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	218.7061	145.2355	91.5723	27.8295	5.2404	0.0000	0.0000	0.0000	0.0000	37.8806	122.9344	216.8037	(98)	
Space heating efficiency (main heating system 1)	212.3111	212.3111	212.3111	212.3111	212.3111	0.0000	0.0000	0.0000	0.0000	212.3111	212.3111	212.3111	(210)	
Space heating fuel (main heating system)	103.0121	68.4069	43.1312	13.1079	2.4682	0.0000	0.0000	0.0000	0.0000	17.8420	57.9029	102.1161	(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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047	(64)	
Efficiency of water heater (217)m	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	(216)	
Fuel for water heating, kWh/month	120.2614	106.5343	113.4927	100.3790	97.7424	88.5376	87.6474	90.8203	91.4909	101.4795	107.2673	119.0124	(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	12.4452	9.9840	8.9895	6.5861	5.0873	4.1564	4.6408	6.0323	7.8353	10.2804	11.6117	12.7911	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.4757	-36.2357	-53.3436	-62.3240	-67.6079	-65.8996	-64.6904	-61.0480	-52.7815	-43.2083	-29.4519	-23.6559	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.8990	-18.3149	-38.0964	-63.4841	-83.2101	-91.0893	-88.6185	-76.0628	-54.6449	-30.6887	-13.1399	-7.7923	(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													407.9874	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													177.8005	
Water heating fuel used													1224.6651	(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)													100.4399	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1162.7634	(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													570.3290	(238)

10a. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	407.9874	27.6700	112.8901	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1224.6651	27.6700	338.8648	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	100.4399	27.6700	27.7917	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-587.7225	27.6700	-162.6228
PV Unit electricity exported	-575.0409	5.8100	-33.4099
Total			-196.0327 (252)
Total energy cost			283.5140 (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	407.9874	0.1577	64.3502 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1224.6651	0.1407	172.3534 (264)
Space and water heating			236.7036 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	100.4399	0.1443	14.4966 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-587.7225	0.1341	-78.8192
PV Unit electricity exported	-575.0409	0.1242	-71.4180
Total			-150.2372 (269)
Total CO2, kg/year			100.9630 (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	407.9874	1.5839	646.1941 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1224.6651	1.5204	1861.9556 (278)
Space and water heating			2508.1496 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	100.4399	1.5338	154.0581 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-587.7225	1.4956	-879.0024
PV Unit electricity exported	-575.0409	0.4558	-262.0758
Total			-1141.0782 (283)
Total Primary energy kWh/year			1521.1295 (286)

SAP 10 EPC IMPROVEMENTS

04 ashdp + PV

Current energy efficiency rating: B 88
Current environmental impact rating: A 98

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

Recommended measures: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
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Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £480	Potential £480	Saving £0
Electricity			
Space heating	£113	£113	£0
Water heating	£339	£339	£0
Lighting	£28	£28	£0
Generated (PV)	-£196	-£196	£0
Total cost of fuels	£284	£284	£0
Total cost of uses	£284	£284	£0
Delivered energy	13 kWh/m²	13 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.1 tonnes	0.1 tonnes	0.0 tonnes
CO2 emissions per m²	2 kg/m²	2 kg/m²	0 kg/m²
Primary energy	35 kWh/m²	35 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3700 (1b)	x 2.3900 (2b)	= 103.6543 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 103.6543 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		Air changes per hour 20.0000 / (5) = 0.1929 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4429 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3101 (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	0.3953	0.3876	0.3798	0.3411	0.3333	0.2946	0.2946	0.2868	0.3101	0.3333	0.3488	0.3643 (22b)
Effective ac	0.5781	0.5751	0.5721	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5608	0.5664 (25)

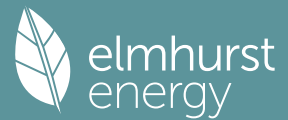
3. Heat losses and heat loss parameter

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						
Main dwelling													
Opening Type 1			1.8900	1.4000	2.6460			(26)					
Opening Type 2			3.6700	1.1450	4.2023			(27)					
Opening Type 3			3.0400	1.1450	3.4809			(27a)					
External Wall 1	37.6800	3.6700	34.0100	0.1600	5.4416	60.0000	2040.6000	(29a)					
External Wall 2	14.8600	1.8900	12.9700	0.1700	2.2049	190.0000	2464.3000	(29a)					
External Roof 1	15.5600		15.5600	0.1100	1.7116	9.0000	140.0400	(30)					
External Roof 2	32.1900	3.0400	29.1500	0.1200	3.4980	9.0000	262.3500	(30)					
Total net area of external elements Aum(A, m2)			100.2900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1853			(33)					
Main dwelling													
Party Floor 1			43.3700			80.0000	3469.6000	(32d)					
Internal Wall 1			56.1800			9.0000	505.6200	(32c)					
Internal Wall 2			23.2300			100.0000	2323.0000	(32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11205.5100	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							258.3701	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E16 Corner (normal)				11.3000	0.0400	0.4520							
E2 Other lintels (including other steel lintels)				3.9600	0.0500	0.1980							
E3 Sill				3.0600	0.0240	0.0734							
E4 Jamb				11.4000	0.0190	0.2166							
E7 Party floor between dwellings (in blocks of flats)				26.3100	0.0320	0.8419							
R1 Head of roof window				3.2000	0.2400	0.7680							
R2 Sill of roof window				3.2000	0.2400	0.7680							
R3 Jamb of roof window				7.6000	0.2400	1.8240							
E11 Eaves (insulation at rafter level)				14.1200	0.0200	0.2824							
E10 Eaves (insulation at ceiling level)				6.3000	0.0840	0.5292							
E12 Gable (insulation at ceiling level)				2.7600	0.0450	0.1242							
E13 Gable (insulation at rafter level)				8.8800	0.0550	0.4884							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5662	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	29.7515	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 19.7759	Feb 19.6721	Mar 19.5704	Apr 19.0925	May 19.0031	Jun 18.5869	Jul 18.5869	Aug 18.5098	Sep 18.7472	Oct 19.0031	Nov 19.1840	Dec 19.3731	(38)
Heat transfer coeff	49.5274	49.4236	49.3219	48.8440	48.7546	48.3384	48.3384	48.2613	48.4987	48.7546	48.9355	49.1246	(39)
Average = Sum(39)m / 12 =												48.8436	
HLP	Jan 1.1420	Feb 1.1396	Mar 1.1372	Apr 1.1262	May 1.1242	Jun 1.1146	Jul 1.1146	Aug 1.1128	Sep 1.1183	Oct 1.1242	Nov 1.1283	Dec 1.1327	(40)
HLP (average)												1.1262	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.4985 (42)
Hot water usage for mixer showers												
	49.3445	48.6029	47.5223	45.4548	43.9290	42.2275	41.2604	42.3328	43.5083	45.3353	47.4472	49.1554 (42a)
Hot water usage for baths												
	21.3430	21.0260	20.5796	19.7566	19.1403	18.4570	18.0879	18.5311	19.0138	19.7449	20.5849	21.2708 (42b)
Hot water usage for other uses												
	29.9762	28.8862	27.7961	26.7061	25.6160	24.5260	24.5260	25.6160	26.7061	27.7961	28.8862	29.9762 (42c)

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Average daily hot water use (litres/day)												92.5333 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.6636	98.5151	95.8981	91.9175	88.6854	85.2105	83.8743	86.4800	89.2282	92.8763	96.9182	100.4024 (44)
Energy content (annual)	159.4266	140.2841	147.3917	125.8305	119.3876	104.7763	101.4387	107.0803	110.0273	126.0323	138.0778	157.2059 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9140	21.0426	22.1088	18.8746	17.9081	15.7164	15.2158	16.0620	16.5041	18.9048	20.7117	23.5809 (46)
Water storage loss (or HIU 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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Total per year (kWh/year) = Sum(64)m =												2177.4610 (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	96.5284	85.9520	92.5268	83.9538	83.2154	76.9533	77.2474	79.1232	78.6993	85.4248	88.0261	95.7900 (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	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.2183	12.6286	10.2702	7.7752	5.8121	4.9068	5.3020	6.8917	9.2500	11.7450	13.7082	14.6135 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.1678	196.1827	191.1053	180.2962	166.6516	153.8276	145.2604	143.2456	148.3230	159.1321	172.7766	185.6006 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895 (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)	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Water heating gains (Table 5)	129.7424	127.9047	124.3640	116.6025	111.8487	106.8796	103.8271	106.3484	109.3045	114.8183	122.2584	128.7500 (72)
Total internal gains	413.5882	412.1757	401.1992	380.1336	359.7721	341.0737	329.8492	331.9454	342.3372	361.1550	384.2029	404.4238 (73)

6. Solar gains												

[Jan]	Area			Solar flux		g		FF		Access		Gains
	m2			Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
West	3.6700			19.6403		0.6300		0.7000		0.7700		22.0285 (80)
East	3.0400			26.0000		0.6300		0.7000		1.0000		31.3710 (82)

Solar gains	53.3995	108.2476	186.7984	284.4877	358.5073	371.1634	351.6636	295.6208	221.2939	130.7668	67.2840	43.4533 (83)
Total gains	466.9877	520.4232	587.9976	664.6213	718.2794	712.2371	681.5129	627.5662	563.6311	491.9219	451.4869	447.8770 (84)

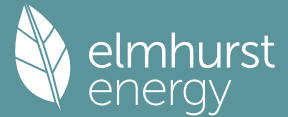
7. Mean internal temperature (heating season)												

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	62.8469	62.9788	63.1088	63.7262	63.8430	64.3928	64.3928	64.4956	64.1799	63.8430	63.6071	63.3622
alpha	5.1898	5.1986	5.2073	5.2484	5.2562	5.2929	5.2929	5.2997	5.2787	5.2562	5.2405	5.2241
util living area	0.9769	0.9590	0.9088	0.7869	0.6093	0.4314	0.3116	0.3528	0.5777	0.8526	0.9574	0.9808 (86)
Living	20.1056	20.2844	20.5637	20.8355	20.9618	20.9948	20.9993	20.9986	20.9782	20.7880	20.4007	20.0676
Non living	18.9676	19.1898	19.5254	19.8328	19.9538	19.9865	19.9888	19.9900	19.9737	19.7953	19.3445	18.9261
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	20.5425	20.2844	20.5637	20.8355	20.9618	20.9948	20.9993	20.9986	20.9782	20.7880	20.4007	20.1981 (87)
Th 2	19.9667	19.9686	19.9705	19.9795	19.9812	19.9890	19.9890	19.9904	19.9860	19.9812	19.9778	19.9742 (88)
util rest of house	0.9702	0.9476	0.8855	0.7431	0.5498	0.3646	0.2403	0.2759	0.4995	0.8081	0.9436	0.9751 (89)
MIT 2	19.5684	19.1898	19.5254	19.8328	19.9538	19.9865	19.9888	19.9900	19.9737	19.7953	19.3445	19.1150 (90)
Living area fraction	fLA = Living area / (4) =											0.5107 (91)
MIT	20.0659	19.7488	20.0557	20.3449	20.4686	20.5015	20.5048	20.5051	20.4867	20.3023	19.8839	19.6681 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0659	19.7488	20.0557	20.3449	20.4686	20.5015	20.5048	20.5051	20.4867	20.3023	19.8839	19.6681 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	453.3978	491.6513	521.9148	504.8107	415.7359	283.9143	188.6009	197.8164	303.6867	404.9818	425.3240	435.8073 (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)

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Heat loss rate W	780.8432	733.8821	668.5910	559.0146	427.5114	285.2669	188.7536	198.1175	309.7471	473.0321	625.5861	759.8648 (97)
Space heating kWh	243.6194	162.7791	109.1271	39.0268	8.7610	0.0000	0.0000	0.0000	0.0000	50.6294	144.1887	241.0987 (98a)
Space heating requirement - total per year (kWh/year)												999.2302
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	243.6194	162.7791	109.1271	39.0268	8.7610	0.0000	0.0000	0.0000	0.0000	50.6294	144.1887	241.0987 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												999.2302
Space heating per m2										(98c) / (4) =		23.0397 (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 %)												212.4490 (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	243.6194	162.7791	109.1271	39.0268	8.7610	0.0000	0.0000	0.0000	0.0000	50.6294	144.1887	241.0987 (98)
Space heating efficiency (main heating system 1)	212.4490	212.4490	212.4490	212.4490	212.4490	0.0000	0.0000	0.0000	0.0000	212.4490	212.4490	212.4490 (210)
Space heating fuel (main heating system)	114.6719	76.6203	51.3663	18.3700	4.1238	0.0000	0.0000	0.0000	0.0000	23.8313	67.8698	113.4855 (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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Efficiency of water heater	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684	177.7684 (216)
Fuel for water heating, kWh/month	120.2831	106.5535	113.5132	100.3972	97.7600	88.5536	87.6632	90.8368	91.5074	101.4978	107.2867	119.0339 (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 (221)
Lighting	12.4452	9.9840	8.9895	6.5861	5.0873	4.1564	4.6408	6.0323	7.8353	10.2804	11.6117	12.7911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-23.7326	-35.1868	-52.6485	-60.6145	-66.8536	-62.9629	-62.1663	-57.7357	-49.6760	-40.3525	-26.4685	-20.2890 (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	-7.5714	-17.0506	-36.3179	-58.6180	-80.4481	-81.8582	-80.7409	-67.1230	-48.1134	-26.4261	-10.6626	-5.9072 (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												470.3389 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.7684
Water heating fuel used												1224.8864 (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)												100.4399 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation			-1079.5246 (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			716.1406 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	470.3389	16.4900	77.5589 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1224.8864	16.4900	201.9838 (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	100.4399	16.4900	16.5625 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-558.6870	16.4900	-92.1275
PV Unit electricity exported	-520.8376	5.5900	-29.1148
Total			-121.2423 (252)
Total energy cost			174.8629 (255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7124 (257)
SAP value		88.4528
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	470.3389	0.1573	73.9686 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1224.8864	0.1407	172.3845 (264)
Space and water heating			246.3531 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	100.4399	0.1443	14.4966 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-558.6870	0.1339	-74.8208
PV Unit electricity exported	-520.8376	0.1242	-64.6782
Total			-139.4989 (269)
Total CO ₂ , kg/year			121.3508 (272)
CO ₂ emissions per m ²			2.8000 (273)
EI value			98.1599
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	43.3700	2.3900	103.6543
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	43.3700		103.6543 (1b) - (3b)
Dwelling volume			103.6543 (4)
			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 103.6543 (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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

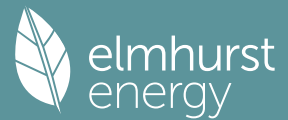
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1929 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4429 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3101 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3566	0.3411	0.3411	0.3178	0.3178	0.2868	0.2868	0.2713	0.2946	0.3256	0.3101	0.3333 (22b)
Effective ac	0.5636	0.5582	0.5582	0.5505	0.5505	0.5411	0.5411	0.5368	0.5434	0.5530	0.5481	0.5556 (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
Main dwelling							
Opening Type 1			1.8900	1.4000	2.6460		(26)
Opening Type 2			3.6700	1.1450	4.2023		(27)
Opening Type 3			3.0400	1.1450	3.4809		(27a)
External Wall 1	37.6800	3.6700	34.0100	0.1600	5.4416	60.0000	2040.6000 (29a)
External Wall 2	14.8600	1.8900	12.9700	0.1700	2.2049	190.0000	2464.3000 (29a)
External Roof 1	15.5600		15.5600	0.1100	1.7116	9.0000	140.0400 (30)
External Roof 2	32.1900	3.0400	29.1500	0.1200	3.4980	9.0000	262.3500 (30)
Total net area of external elements A _{um} (A, m ²)			100.2900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 23.1853		(33)
Main dwelling							
Party Floor 1			43.3700			80.0000	3469.6000 (32d)
Internal Wall 1			56.1800			9.0000	505.6200 (32c)

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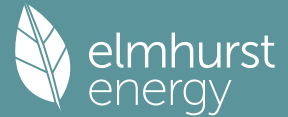
Internal Wall 2	23.2300	100.0000	2323.0000 (32c)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	11205.5100 (34)		
List of Thermal Bridges	258.3701 (35)		
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.3000	0.0400	0.4520
E2 Other lintels (including other steel lintels)	3.9600	0.0500	0.1980
E3 Sill	3.0600	0.0240	0.0734
E4 Jamb	11.4000	0.0190	0.2166
E7 Party floor between dwellings (in blocks of flats)	26.3100	0.0320	0.8419
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	7.6000	0.2400	1.8240
E11 Eaves (insulation at rafter level)	14.1200	0.0200	0.2824
E10 Eaves (insulation at ceiling level)	6.3000	0.0840	0.5292
E12 Gable (insulation at ceiling level)	2.7600	0.0450	0.1242
E13 Gable (insulation at rafter level)	8.8800	0.0550	0.4884
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5662 (36)		
Point Thermal bridges	(36a) = 0.0000		
Total fabric heat loss	(33) + (36) + (36a) = 29.7515 (37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	19.2775	19.0925	19.0925
Average = Sum(39)m / 12 =	48.8440	48.8440	48.8440
HLP	Jan	Feb	Mar
HLP (average)	1.1305	1.1262	1.1262
Days in mont	31	28	31
	Apr	May	Jun
	1.1202	1.1202	1.1128
	30	31	30
	Jul	Aug	Sep
	1.1128	1.1094	1.1146
	31	31	30
	Oct	Nov	Dec
	1.1221	1.1183	1.1242 (40)
	31	30	1.1198
			31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy	1.4985 (42)											
Hot water usage for mixer showers												
Hot water usage for baths	49.3445	48.6029	47.5223	45.4548	43.9290	42.2275	41.2604	42.3328	43.5083	45.3353	47.4472	49.1554 (42a)
Hot water usage for other uses	21.3430	21.0260	20.5796	19.7566	19.1403	18.4570	18.0879	18.5311	19.0138	19.7449	20.5849	21.2708 (42b)
Average daily hot water use (litres/day)	29.9762	28.8862	27.7961	26.7061	25.6160	24.5260	24.5260	25.6160	26.7061	27.7961	28.8862	29.9762 (42c)
	92.5333 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.6636	98.5151	95.8981	91.9175	88.6854	85.2105	83.8743	86.4800	89.2282	92.8763	96.9182	100.4024 (44)
Energy content (annual)	159.4266	140.2841	147.3917	125.8305	119.3876	104.7763	101.4387	107.0803	110.0273	126.0323	138.0778	157.2059 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9140	21.0426	22.1088	18.8746	17.9081	15.7164	15.2158	16.0620	16.5041	18.9048	20.7117	23.5809 (46)
Water storage loss (or HIU 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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	96.5284	85.9520	92.5268	83.9538	83.2154	76.9533	77.2474	79.1232	78.6993	85.4248	88.0261	95.7900 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												

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	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104	89.9104 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.2183	12.6286	10.2702	7.7752	5.8121	4.9068	5.3020	6.8917	9.2500	11.7450	13.7082	14.6135 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.1678	196.1827	191.1053	180.2962	166.6516	153.8276	145.2604	143.2456	148.3230	159.1321	172.7766	185.6006 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895	45.4895 (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)	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403	-59.9403 (71)
Water heating gains (Table 5)	129.7424	127.9047	124.3640	116.6025	111.8487	106.8796	103.8271	106.3484	109.3045	114.8183	122.2584	128.7500 (72)
Total internal gains	413.5882	412.1757	401.1992	380.1336	359.7721	341.0737	329.8492	331.9454	342.3372	361.1550	384.2029	404.4238 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						

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		W/m2	or Table 6b	or Table 6c	Table 6d	

West	3.6700	23.8018	0.6300	0.7000	0.7700	26.6961 (80)
East	3.0400	32.0000	0.6300	0.7000	1.0000	38.6104 (82)

Solar gains	65.3065	115.5960	195.5759	304.1943	370.4810	405.3841	380.3921	328.3855	247.1369	147.7913	79.0265	53.4510 (83)
Total gains	478.8947	527.7716	596.7751	684.3279	730.2530	746.4578	710.2413	660.3309	589.4741	508.9463	463.2294	457.8747 (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	63.4857	63.7262	63.7262	64.0699	64.0699	64.4956	64.4956	64.6940	64.3928	63.9576	64.1799	63.8430
alpha	5.2324	5.2484	5.2484	5.2713	5.2713	5.2997	5.2997	5.3129	5.2929	5.2638	5.2787	5.2562
util living area	0.9713	0.9514	0.8913	0.7449	0.5588	0.3610	0.2513	0.2767	0.5165	0.8165	0.9454	0.9759 (86)
Living	20.1929	20.3599	20.6326	20.8816	20.9765	20.9981	20.9998	20.9997	20.9881	20.8396	20.4867	20.1585
Non living	19.0837	19.2908	19.6126	19.8832	19.9688	19.9896	19.9904	19.9931	19.9829	19.8491	19.4549	19.0453
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	20.5871	20.3599	20.6326	20.8816	20.9765	20.9981	20.9998	20.9997	20.9881	20.8396	20.4867	20.2762 (87)
Th 2	19.9760	19.9795	19.9795	19.9844	19.9844	19.9904	19.9904	19.9932	19.9890	19.9828	19.9860	19.9812 (88)
util rest of house	0.9630	0.9380	0.8642	0.6967	0.4977	0.2965	0.1828	0.2035	0.4386	0.7648	0.9278	0.9687 (89)
MIT 2	19.6203	19.2908	19.6126	19.8832	19.9688	19.9896	19.9904	19.9931	19.9829	19.8491	19.4549	19.2139 (90)
Living area fraction	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (91)
MIT	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1141	19.8368	20.1336	20.3931	20.4834	20.5047	20.5059	20.5072	20.4963	20.3550	19.9819	19.7565 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9643	0.9358	0.8687	0.7168	0.5281	0.3294	0.2178	0.2409	0.4781	0.7850	0.9278	0.9668 (94)
Ext temp.	461.7762	493.9108	518.4146	490.5558	385.6656	245.8940	154.6833	159.0564	281.8388	399.4991	429.7633	442.6684 (95)
Heat loss rate W	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000 (96)
Space heating kWh	755.7361	710.0351	641.4957	529.2080	392.7091	246.3580	154.7209	159.1193	285.0160	450.4140	600.5055	734.0712 (97)
Space heating requirement - total per year (kWh/year)	218.7061	145.2355	91.5723	27.8295	5.2404	0.0000	0.0000	0.0000	0.0000	37.8806	122.9344	216.8037 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	218.7061	145.2355	91.5723	27.8295	5.2404	0.0000	0.0000	0.0000	0.0000	37.8806	122.9344	216.8037 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												866.2025
Space heating per m2												19.9724 (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 %)												212.3111 (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
218.7061	145.2355	91.5723	27.8295	5.2404	0.0000	0.0000	0.0000	0.0000	0.0000	37.8806	122.9344	216.8037 (98)
Space heating efficiency (main heating system 1)	212.3111	212.3111	212.3111	212.3111	212.3111	0.0000	0.0000	0.0000	0.0000	212.3111	212.3111	212.3111 (210)
Space heating fuel (main heating system)	103.0121	68.4069	43.1312	13.1079	2.4682	0.0000	0.0000	0.0000	0.0000	17.8420	57.9029	102.1161 (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	213.8254	189.4185	201.7905	178.4745	173.7864	157.4203	155.8375	161.4791	162.6713	180.4311	190.7218	211.6047 (64)
Efficiency of water heater	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005	177.8005 (216)
Fuel for water heating, kWh/month	120.2614	106.5343	113.4927	100.3790	97.7424	88.5376	87.6474	90.8203	91.4909	101.4795	107.2673	119.0124 (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	12.4452	9.9840	8.9895	6.5861	5.0873	4.1564	4.6408	6.0323	7.8353	10.2804	11.6117	12.7911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-27.4757	-36.2357	-53.3436	-62.3240	-67.6079	-65.8996	-64.6904	-61.0480	-52.7815	-43.2083	-29.4519	-23.6559 (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)	-9.8990	-18.3149	-38.0964	-63.4841	-83.2101	-91.0893	-88.6185	-76.0628	-54.6449	-30.6887	-13.1399	-7.7923 (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)

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Annual totals kWh/year	
Space heating fuel - main system 1	407.9874 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	177.8005
Water heating fuel used	1224.6651 (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)	100.4399 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1162.7634 (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	570.3290 (238)

10a. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	407.9874	27.6700	112.8901 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1224.6651	27.6700	338.8648 (247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	100.4399	27.6700	27.7917 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-587.7225	27.6700	-162.6228
PV Unit electricity exported	-575.0409	5.8100	-33.4099
Total			-196.0327 (252)
Total energy cost			283.5140 (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	407.9874	0.1577	64.3502 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1224.6651	0.1407	172.3534 (264)
Space and water heating			236.7036 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	100.4399	0.1443	14.4966 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-587.7225	0.1341	-78.8192
PV Unit electricity exported	-575.0409	0.1242	-71.4180
Total			-150.2372 (269)
Total CO2, kg/year			100.9630 (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	407.9874	1.5839	646.1941 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1224.6651	1.5204	1861.9556 (278)
Space and water heating			2508.1496 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	100.4399	1.5338	154.0581 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-587.7225	1.4956	-879.0024
PV Unit electricity exported	-575.0409	0.4558	-262.0758
Total			-1141.0782 (283)
Total Primary energy kWh/year			1521.1295 (286)