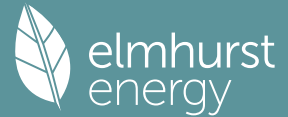


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Property Reference	OP-D320 A4HAWT				Issued on Date	29/11/2024
Assessment Reference	A4HAWT	Prop Type Ref	A4HAWT			
Property	A4HAWT					
SAP Rating	81 B	DER	4.01	TER	10.85	
Environmental	96 A	% DER < TER				63.04
CO ₂ Emissions (t/year)	0.42	DFEE	37.07	TFEE	37.68	
Compliance Check	See BREL	% DFEE < TFEE				1.61
% DPER < TPER	25.48	DPER	42.34	TPER	56.81	
Assessor Details	Mr. Matthew Stainrod				Assessor ID	AU83-0001
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)
Ground floor	44.1800 (1b)	x 2.3100 (2b)	= 102.0558 (1b) - (3b)
First floor	39.9600 (1c)	x 2.6100 (2c)	= 104.2956 (1c) - (3c)
Second floor	28.3600 (1d)	x 2.4500 (2d)	= 69.4820 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.8334 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.5000 (17)
Infiltration rate	0.1750 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1487 (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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3297	0.3259	0.3222	0.3036	0.2999	0.2813	0.2813	0.2776	0.2888	0.2999	0.3073	0.3148 (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
Front Door			4.2800	1.0000	4.2800		(26)
Windows (Uw = 1.30)			13.6500	1.2357	16.8679		(27)
Ground Floor			44.1800	0.1100	4.8598		(28a)
External Wall	101.0000	14.9300	86.0700	0.1700	14.6319		(29a)
Dormer Cheeks	6.7500	3.0000	3.7500	0.1900	0.7125		(29a)
Stud Wall	19.0400		19.0400	0.1700	3.2368		(29a)
Roof - ceiling	29.4300		29.4300	0.1100	3.2373		(30)
Roof - pitch	14.9200		14.9200	0.2000	2.9840		(30)
Dormer Roof	3.6300		3.6300	0.2000	0.7260		(30)
Total net area of external elements Aum(A, m ²)			218.9500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5362		(33)
Party Wall			57.8100	0.0000	0.0000		(32)

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

100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	10.7900	0.0500	0.5395
E2 Other lintels (including other steel lintels)	8.7500	0.0500	0.4375
E3 Sill	24.9000	0.0500	1.2450
E4 Jamb	18.8000	0.1600	3.0080
E5 Ground floor (normal)	18.6500	0.0000	0.0000
E6 Intermediate floor within a dwelling	9.3800	0.0600	0.5628
E10 Eaves (insulation at ceiling level)	6.8800	0.0600	0.4128
E12 Gable (insulation at ceiling level)	21.0300	0.0900	1.8927
E16 Corner (normal)	9.8400	0.0600	0.5904
E18 Party wall between dwellings	9.4200	0.0800	0.7536
P1 Party wall - Ground floor	13.9600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	6.8800	0.1200	0.8256
P4 Party wall - Roof (insulation at ceiling level)	7.1600	-0.0900	-0.6444
E17 Corner (inverted - internal area greater than external area)	13.3000	0.2400	3.1920
E24 Eaves (insulation at ceiling level - inverted)	4.6900	0.0400	0.1876
E11 Eaves (insulation at rafter level)	6.8800	0.0800	0.5504
E13 Gable (insulation at rafter level)	9.2100	0.0600	0.5526
E18 Party wall between dwellings	3.5800	0.0600	0.2148
E25 Staggered party wall between dwellings	3.4200	0.0800	0.2736
P5 Party wall - Roof (insulation at rafter level)	2.5000	0.0800	0.2000
R1 Head of roof window	2.5000	0.0600	0.1500
R2 Sill of roof window	4.8000	0.0800	0.3840
R3 Jamb of roof window	4.6900	0.0400	0.1876
R5 Ridge (inverted)	17.2800	0.0600	1.0368
R6 Flat ceiling	2.9000	0.0400	0.1160
R7 Flat ceiling (inverted)	16.4500	0.0600	0.9870
R8 Roof to wall (rafter)			

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

17.6559 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.1921 (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	30.0070	29.6685	29.3300	27.6375	27.2990	25.6065	25.6065	25.2680	26.2835	27.2990	27.9760	28.6530
Heat transfer coeff	99.1990	98.8605	98.5220	96.8295	96.4910	94.7985	94.7985	94.4600	95.4755	96.4910	97.1680	97.8450
Average = Sum(39)m / 12 =												96.7449

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8818	0.8788	0.8758	0.8607	0.8577	0.8427	0.8427	0.8396	0.8487	0.8577	0.8637	0.8697
HLP (average)												0.8600
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

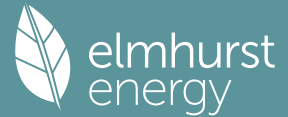
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8290 (42)
Hot water usage for mixer showers	98.5233	97.0427	94.8851	90.7571	87.7107	84.3133	82.3823	84.5235	86.8707	90.5184	94.7351	98.1458 (42a)	
Hot water usage for baths	32.5647	32.0811	31.4000	30.1443	29.2040	28.1614	27.5982	28.2745	29.0109	30.1265	31.4081	32.4546 (42b)	
Hot water usage for other uses	45.8969	44.2279	42.5590	40.8900	39.2210	37.5520	37.5520	39.2210	40.8900	42.5590	44.2279	45.8969 (42c)	
Average daily hot water use (litres/day)												162.7523 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	176.9850	173.3517	168.8442	161.7914	156.1357	150.0268	147.5325	152.0190	156.7715	163.2039	170.3712	176.4974 (44)	
Energy content (annual)	280.3009	246.8506	259.5072	221.4843	210.1886	184.4754	178.4278	188.2313	193.3150	221.4661	242.7250	276.3523 (45)	
Distribution loss (46)m = 0.15 x (45)m	42.0451	37.0276	38.9261	33.2226	31.5283	27.6713	26.7642	28.2347	28.9972	33.2199	36.4087	41.4528 (46)	
Water storage loss:													
Store volume												230.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)	
Temperature factor from Table 2b												0.7800 (49)	
Enter (49) or (54) in (55)												1.4040 (55)	
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (56)	
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	378.6825	335.7114	357.8888	316.6923	308.5702	249.1074	245.2142	255.0177	257.9470	319.8477	337.9330	374.7339 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
FV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	378.6825	335.7114	357.8888	316.6923	308.5702	249.1074	245.2142	255.0177	257.9470	319.8477	337.9330	374.7339 (64)	
12Total per year (kWh/year)												3737.3460 (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	137.0861	121.7169	130.1722	116.1139	113.7738	79.3477	77.9372	81.1968	82.2868	117.5236	123.1765	135.7732 (65)	

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

Metabolic gains (Table 5), Watts												
(66)m	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6381	170.0993	153.6381	158.7594	153.6381	158.7594	153.6381	158.7594	153.6381	158.7594	153.6381	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.1000	277.9547	270.7610	255.4465	236.1146	217.9454	205.8073	202.9526	210.1463	225.4608	244.7927	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Losses e.g. evaporation (negative values) (Table 5)	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	
Water heating gains (Table 5)												

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Total internal gains	184.2556	181.1263	174.9627	161.2693	152.9218	110.2051	104.7543	109.1355	114.2873	157.9618	171.0784	182.4909 (72)
	678.4291	694.6157	664.7972	640.9106	608.1099	552.3453	529.6351	531.1616	548.6283	602.4961	640.0659	664.5262 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.2200		10.6334		0.6300		0.7000		0.7700		23.4629 (74)	
East	1.4500		19.6403		0.6300		0.7000		0.7700		8.7034 (76)	
South	4.9800		46.7521		0.6300		0.7000		0.7700		71.1544 (78)	
Solar gains	103.3207	178.3970	252.6726	331.0482	389.8063	396.0408	378.0068	332.3277	279.2827	199.2683	124.1388	88.2010 (83)
Total gains	781.7497	873.0127	917.4698	971.9588	997.9162	948.3861	907.6419	863.4893	827.9111	801.7645	764.2046	752.7272 (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	31.5023	31.6102	31.7188	32.2732	32.3864	32.9646	32.9646	33.0828	32.7309	32.3864	32.1608	31.9383
alpha	3.1002	3.1073	3.1146	3.1515	3.1591	3.1976	3.1976	3.2055	3.1821	3.1591	3.1441	3.1292
util living area	0.9460	0.9237	0.8925	0.8247	0.7178	0.5745	0.4381	0.4739	0.6681	0.8370	0.9200	0.9510 (86)
Living	19.1674	19.4289	19.7788	20.2545	20.6348	20.8745	20.9604	20.9486	20.7861	20.3295	19.6969	19.1370
Non living	18.0255	18.3551	18.7944	19.3875	19.8384	20.1112	20.1914	20.1849	20.0201	19.4890	18.7050	17.9940
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	20.0625	19.4289	19.7788	20.2545	20.6348	20.8745	20.9604	20.9486	20.7861	20.3295	19.6969	19.3976 (87)
Th 2	20.1830	20.1856	20.1882	20.2010	20.2036	20.2165	20.2165	20.2191	20.2113	20.2036	20.1985	20.1933 (88)
util rest of house	0.9392	0.9142	0.8789	0.8021	0.6808	0.5188	0.3671	0.4026	0.6158	0.8114	0.9086	0.9448 (89)
MIT 2	19.3229	18.3551	18.7944	19.3875	19.8384	20.1112	20.1914	20.1849	20.0201	19.4890	18.7050	18.3903 (90)
Living area fraction	19.4314	18.5126	18.9388	19.5146	19.9552	20.2232	20.3042	20.2969	20.1325	19.6123	18.8505	0.1467 (91)
MIT	19.4314	18.5126	18.9388	19.5146	19.9552	20.2232	20.3042	20.2969	20.1325	19.6123	18.8505	18.5381 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4314	18.5126	18.9388	19.5146	19.9552	20.2232	20.3042	20.2969	20.1325	19.6123	18.8505	18.5381 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9319	0.8898	0.8534	0.7799	0.6683	0.5193	0.3753	0.4099	0.6102	0.7895	0.8846	0.9285 (94)
Useful gains	728.5076	776.8291	783.0012	758.0225	666.9107	492.4574	340.6227	353.9785	505.2031	632.9595	675.9784	698.8907 (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	1501.0185	1345.7509	1225.4981	1027.8108	796.5520	533.0675	351.1523	368.1003	575.9547	869.6052	1141.7697	1402.9092 (97)
Space heating kWh	574.7482	382.3155	329.2177	194.2476	96.4531	0.0000	0.0000	0.0000	0.0000	176.0644	335.3697	523.7898 (98a)
Space heating requirement - total per year (kWh/year)												2612.2059
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	574.7482	382.3155	329.2177	194.2476	96.4531	0.0000	0.0000	0.0000	0.0000	176.0644	335.3697	523.7898 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2612.2059
Space heating per m2										(98c) / (4) =		23.2196 (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 %)												251.7125 (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	574.7482	382.3155	329.2177	194.2476	96.4531	0.0000	0.0000	0.0000	0.0000	176.0644	335.3697	523.7898 (98)
Space heating efficiency (main heating system 1)	251.7125	251.7125	251.7125	251.7125	251.7125	0.0000	0.0000	0.0000	0.0000	251.7125	251.7125	251.7125 (210)
Space heating fuel (main heating system)	228.3351	151.8858	130.7911	77.1704	38.3187	0.0000	0.0000	0.0000	0.0000	69.9466	133.2352	208.0904 (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	378.6825	335.7114	357.8888	316.6923	308.5702	249.1074	245.2142	255.0177	257.9470	319.8477	337.9330	374.7339 (64)
Efficiency of water heater (217)m	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222 (216)
Fuel for water heating, kWh/month	140.5536	124.6042	132.8357	117.5450	114.5304	92.4598	91.0148	94.6535	95.7408	118.7161	125.4288	139.0879 (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	34.8115	31.4426	34.8115	33.6886	34.8115	33.6886	34.8115	34.8115	33.6886	34.8115	33.6886	34.8115 (231)
Lighting	31.9230	25.6098	23.0588	16.8938	13.0493	10.6614	11.9040	15.4733	20.0982	26.3700	29.7848	32.8102 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1037.7734	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												269.4222	
Water heating fuel used												1387.1706	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2180)													
mechanical ventilation fans (SFP = 1.2180)												409.8774	(230a)
Total electricity for the above, kWh/year												409.8774	(231)
Electricity for lighting (calculated in Appendix L)												257.6366	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3092.4580	(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	1037.7734	0.1553	161.1748	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1387.1706	0.1415	196.3336	(264)
Space and water heating			357.5084	(265)
Pumps, fans and electric keep-hot	409.8774	0.1387	56.8550	(267)
Energy for lighting	257.6366	0.1443	37.1849	(268)
Total CO2, kg/year			451.5484	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0100	(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	1037.7734	1.5749	1634.4353	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1387.1706	1.5234	2113.2016	(278)
Space and water heating			3747.6369	(279)
Pumps, fans and electric keep-hot	409.8774	1.5128	620.0625	(281)
Energy for lighting	257.6366	1.5338	395.1716	(282)
Total Primary energy kWh/year			4762.8710	(286)
Dwelling Primary energy Rate (DPER)			42.3400	(287)

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

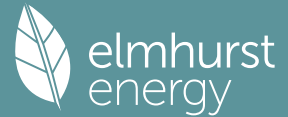
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.1800 (1b)	x	2.3100 (2b)	=	102.0558 (1b)	- (3b)
First floor	39.9600 (1c)	x	2.6100 (2c)	=	104.2956 (1c)	- (3c)
Second floor	28.3600 (1d)	x	2.4500 (2d)	=	69.4820 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	112.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	=	275.8334	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1450 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3950 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3358 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.4281	0.4197	0.4113	0.3693	0.3609	0.3190	0.3190	0.3106	0.3358	0.3609	0.3777	0.3945	(22b)
	0.5916	0.5881	0.5846	0.5682	0.5651	0.5509	0.5509	0.5482	0.5564	0.5651	0.5713	0.5778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			4.2800	1.0000	4.2800			(26)
TER Opening Type (Uw = 1.20)			13.6500	1.1450	15.6298			(27)
Ground Floor			44.1800	0.1300	5.7434			(28a)
External Wall	101.0000	14.9300	86.0700	0.1800	15.4926			(29a)
Dormer Cheeks	6.7500	3.0000	3.7500	0.1800	0.6750			(29a)
Stud Wall	19.0400		19.0400	0.1800	3.4272			(29a)
Roof - ceiling	29.4300		29.4300	0.1100	3.2373			(30)
Roof - pitch	14.9200		14.9200	0.1100	1.6412			(30)
Dormer Roof	3.6300		3.6300	0.1100	0.3993			(30)
Total net area of external elements Aum(A, m2)			218.9500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 50.5258			(33)
Party Wall			57.8100	0.0000	0.0000			(32)

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

100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	10.7900	0.0500	0.5395	
E2 Other lintels (including other steel lintels)	8.7500	0.0500	0.4375	
E3 Sill	24.9000	0.0500	1.2450	
E4 Jamb	18.8000	0.1600	3.0080	
E5 Ground floor (normal)	18.6500	0.0000	0.0000	
E6 Intermediate floor within a dwelling	9.3800	0.0600	0.5628	
E10 Eaves (insulation at ceiling level)	6.8800	0.0600	0.4128	
E12 Gable (insulation at ceiling level)	21.0300	0.0900	1.8927	
E16 Corner (normal)	9.8400	0.0600	0.5904	
E18 Party wall between dwellings	9.4200	0.0800	0.7536	
P1 Party wall - Ground floor	13.9600	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	6.8800	0.1200	0.8256	
P4 Party wall - Roof (insulation at ceiling level)	7.1600	-0.0900	-0.6444	
E17 Corner (inverted - internal area greater than external area)	13.3000	0.2400	3.1920	
E24 Eaves (insulation at ceiling level - inverted)	4.6900	0.0400	0.1876	
E11 Eaves (insulation at rafter level)	6.8800	0.0800	0.5504	
E13 Gable (insulation at rafter level)	9.2100	0.0600	0.5526	
E18 Party wall between dwellings	3.5800	0.0600	0.2148	
E25 Staggered party wall between dwellings	3.4200	0.0800	0.2736	
P5 Party wall - Roof (insulation at rafter level)	2.5000	0.0800	0.2000	
R1 Head of roof window	2.5000	0.0600	0.1500	
R2 Sill of roof window	4.8000	0.0800	0.3840	
R3 Jamb of roof window	4.6900	0.0400	0.1876	
R5 Ridge (inverted)	17.2800	0.0600	1.0368	
R6 Flat ceiling	2.9000	0.0400	0.1160	
R7 Flat ceiling (inverted)	16.4500	0.0600	0.9870	
R8 Roof to wall (rafter)				

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

17.6559 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 68.1817 (37)

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

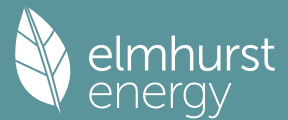
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	53.8535	53.5296	53.2121	51.7209	51.4419	50.1432	50.1432	49.9027	50.6434	51.4419	52.0063	52.5964	(38)
Average = Sum(39)m / 12 =	122.0351	121.7113	121.3938	119.9026	119.6236	118.3248	118.3248	118.0843	118.8251	119.6236	120.1880	120.7781	(39)
												119.9013	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0848	1.0819	1.0791	1.0658	1.0633	1.0518	1.0518	1.0496	1.0562	1.0633	1.0683	1.0736	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8290 (42)
Hot water usage for mixer showers													
Hot water usage for baths	71.6533	70.5765	69.0074	66.0052	63.7896	61.3188	59.9144	61.4716	63.1787	65.8315	68.8983	71.3788	(42a)
Hot water usage for other uses	30.9365	30.4770	29.8300	28.6371	27.7438	26.7533	26.2183	26.8608	27.5603	28.6202	29.8377	30.8319	(42b)
Average daily hot water use (litres/day)	43.6021	42.0165	40.4310	38.8455	37.2600	35.6744	35.6744	37.2600	38.8455	40.4310	42.0165	43.6021	(42c)
												134.3832	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	146.1919	143.0701	139.2684	133.4877	128.7933	123.7465	121.8071	125.5924	129.5845	134.8827	140.7525	145.8128	(44)
Energy content (annual)	231.5322	203.7299	214.0504	182.7380	173.3806	152.1608	147.3152	155.5096	159.7906	183.0346	200.5278	228.3076	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	34.7298	30.5595	32.1076	27.4107	26.0071	22.8241	22.0973	23.3264	23.9686	27.4552	30.0792	34.2461	(46)
Store volume												230.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7973	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9706	(55)

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Total storage loss	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872 (56)
If cylinder contains dedicated solar storage	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872 (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	284.8818	251.9167	267.4000	234.3667	226.7302	203.7895	200.6648	208.8592	211.4193	236.3842	252.1564	281.6572 (62)
WWHRS	-32.7569	-28.9705	-30.3362	-25.1196	-23.4105	-20.0326	-18.7773	-19.9678	-20.7265	-24.4342	-27.6810	-32.1503 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.1249	222.9462	237.0638	209.2471	203.3197	183.7569	181.8874	188.8914	190.6928	211.9500	224.4754	249.5069 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2555.8626 (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	119.6642	106.2896	113.8515	102.0633	100.3287	91.8964	91.6620	94.3866	94.4333	103.5387	107.9784	118.5920 (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	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6381	170.0993	153.6381	158.7594	153.6381	158.7594	153.6381	153.6381	158.7594	153.6381	158.7594	153.6381	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.1000	277.9547	270.7610	255.4465	236.1146	217.9454	205.8073	202.9526	210.1463	225.4608	244.7927	262.9619	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	(71)
Water heating gains (Table 5)	160.8389	158.1690	153.0262	141.7546	134.8505	127.6339	123.2016	126.8638	131.1574	139.1649	149.9700	159.3978	(72)
Total internal gains	658.0124	674.6585	645.8607	624.3959	593.0386	569.7741	548.0824	548.8899	565.4985	586.6993	621.9575	644.4332	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				7.2200	10.6334	0.6300	0.7000		0.7700		23.4629 (74)	
East				1.4500	19.6403	0.6300	0.7000		0.7700		8.7034 (76)	
South				4.9800	46.7521	0.6300	0.7000		0.7700		71.1544 (78)	
Solar gains	103.3207	178.3970	252.6726	331.0482	389.8063	396.0408	378.0068	332.3277	279.2827	199.2683	124.1388	88.2010 (83)
Total gains	761.3331	853.0554	898.5333	955.4441	982.8449	965.8148	926.0892	881.2175	844.7812	785.9676	746.0963	732.6342 (84)

7. Mean internal temperature (heating season)

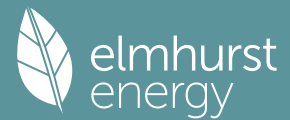
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.6074	25.6755	25.7427	26.0628	26.1236	26.4103	26.4103	26.4641	26.2992	26.1236	26.0009	25.8739	
alpha	2.7072	2.7117	2.7162	2.7375	2.7416	2.7607	2.7607	2.7643	2.7533	2.7416	2.7334	2.7249	
util living area	0.9553	0.9380	0.9141	0.8623	0.7763	0.6398	0.5055	0.5424	0.7225	0.8726	0.9357	0.9593	(86)
MIT	18.5692	18.8476	19.2554	19.8294	20.3469	20.7385	20.9015	20.8775	20.6074	19.9568	19.1859	18.5306	(87)
Th 2	20.0133	20.0157	20.0180	20.0289	20.0309	20.0404	20.0404	20.0422	20.0367	20.0309	20.0268	20.0225	(88)
util rest of house	0.9489	0.9292	0.9014	0.8404	0.7378	0.5738	0.4129	0.4512	0.6645	0.8481	0.9252	0.9535	(89)
MIT 2	17.1691	17.5213	18.0362	18.7557	19.3800	19.8249	19.9809	19.9639	19.6904	18.9241	17.9601	17.1256	(90)
Living area fraction	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(91)
MIT	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(92)
Temperature adjustment	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9246	0.9013	0.8707	0.8097	0.7145	0.5677	0.4206	0.4569	0.6500	0.8179	0.8973	0.9305	(94)
Ext temp.	703.9292	768.8523	782.3944	773.6059	702.2097	548.2990	389.5593	402.6107	549.1238	642.8667	669.4736	681.7133	(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	1595.5430	1559.8278	1422.1254	1200.6019	935.6743	634.0867	416.0207	436.6593	680.2579	1013.8723	1326.8632	1586.0185	(97)
Space heating requirement - total per year (kWh/year)	663.3607	531.5356	475.9599	307.4371	173.6977	0.0000	0.0000	0.0000	0.0000	276.0282	473.3205	672.8031	(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)	663.3607	531.5356	475.9599	307.4371	173.6977	0.0000	0.0000	0.0000	0.0000	276.0282	473.3205	672.8031	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3574.1427												
Space heating per m2	(98c) / (4) =											31.7702	(99)

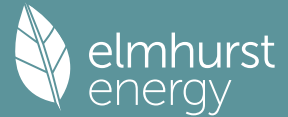
9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	663.3607	531.5356	475.9599	307.4371	173.6977	0.0000	0.0000	0.0000	0.0000	276.0282	473.3205	672.8031	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	718.7006	575.8782	515.6662	333.0846	188.1882	0.0000	0.0000	0.0000	0.0000	299.0555	512.8066	728.9308	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.1249	222.9462	237.0638	209.2471	203.3197	183.7569	181.8874	188.8914	190.6928	211.9500	224.4754	249.5069	(64)
Efficiency of water heater	86.1249	85.9360	85.5906	84.9213	83.7087	79.8000	79.8000	79.8000	79.8000	84.6532	85.6910	86.1709	(217)
Fuel for water heating, kWh/month	292.7432	259.4327	276.9742	246.4013	242.8895	230.2718	227.9291	236.7060	238.9634	250.3746	261.9590	289.5489	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	31.9230	25.6098	23.0588	16.8938	13.0493	10.6614	11.9040	15.4733	20.0982	26.3700	29.7848	32.8102	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.2754	-60.0794	-87.0122	-98.5537	-106.8223	-99.8442	-98.5750	-92.7889	-82.6715	-69.0076	-46.6344	-36.4906	(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	-22.4128	-47.3242	-94.4081	-142.3170	-188.7130	-189.8588	-187.6623	-158.6739	-115.9876	-67.8920	-29.9895	-17.7130	(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												3872.3106	(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												3054.1938	(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)												257.6366	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-2183.7072	(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												5086.4338	(238)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP													
	Energy							Emission factor				Emissions	
	kWh/year							kg CO2/kWh				kg CO2/year	
Space heating - main system 1	3872.3106							0.2100				813.1852	(261)
Total CO2 associated with community systems												0.0000	(373)
Water heating (other fuel)	3054.1938							0.2100				641.3807	(264)
Space and water heating												1454.5659	(265)
Pumps, fans and electric keep-hot	86.0000							0.1387				11.9293	(267)
Energy for lighting	257.6366							0.1443				37.1849	(268)
Energy saving/generation technologies													
PV Unit electricity used in dwelling	-920.7551							0.1344				-123.7864	
PV Unit electricity exported	-1262.9521							0.1258				-158.8564	
Total												-282.6428	(269)
Total CO2, kg/year												1221.0373	(272)
EPC Target Carbon Dioxide Emission Rate (TER)												10.8500	(273)
13a. Primary energy - Individual heating systems including micro-CHP													
	Energy							Primary energy factor				Primary energy	
	kWh/year							kg CO2/kWh				kWh/year	
Space heating - main system 1	3872.3106							1.1300				4375.7110	(275)
Total CO2 associated with community systems												0.0000	(473)
Water heating (other fuel)	3054.1938							1.1300				3451.2390	(278)
Space and water heating												7826.9500	(279)
Pumps, fans and electric keep-hot	86.0000							1.5128				130.1008	(281)
Energy for lighting	257.6366							1.5338				395.1716	(282)
Energy saving/generation technologies													
PV Unit electricity used in dwelling	-920.7551							1.4969				-1378.2413	
PV Unit electricity exported	-1262.9521							0.4617				-583.1049	
Total												-1961.3461	(283)
Total Primary energy kWh/year												6390.8762	(286)
Target Primary Energy Rate (TPER)												56.8100	(287)

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Property Reference	OP-D320 A4HAWT				Issued on Date	29/11/2024	
Assessment Reference	A4HAWT		Prop Type Ref	A4HAWT			
Property	A4HAWT						
SAP Rating	81 B	DER	4.01	TER	10.85		
Environmental	96 A	% DER < TER				63.04	
CO ₂ Emissions (t/year)	0.42	DFEE	37.07	TFEE	37.68		
Compliance Check	See BREL	% DFEE < TFEE				1.61	
% DPER < TPER	25.48	DPER	42.34	TPER	56.81		
Assessor Details	Mr. Matthew Stainrod				Assessor ID	AU83-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.1800 (1b)	x 2.3100 (2b)	= 102.0558 (1b) - (3b)
First floor	39.9600 (1c)	x 2.6100 (2c)	= 104.2956 (1c) - (3c)
Second floor	28.3600 (1d)	x 2.4500 (2d)	= 69.4820 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.8334 (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	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1450 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.5000	(17)
Infiltration rate	0.3200	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2720 (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	0.3468	0.3400	0.3332	0.2992	0.2924	0.2584	0.2584	0.2516	0.2720	0.2924	0.3060	0.3196 (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	0.5601	0.5578	0.5555	0.5448	0.5428	0.5334	0.5334	0.5317	0.5370	0.5428	0.5468	0.5511 (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
Front Door			4.2800	1.0000	4.2800		(26)
Windows (Uw = 1.30)			13.6500	1.2357	16.8679		(27)
Ground Floor			44.1800	0.1100	4.8598		(28a)
External Wall	101.0000	14.9300	86.0700	0.1700	14.6319		(29a)
Dormer Cheeks	6.7500	3.0000	3.7500	0.1900	0.7125		(29a)
Stud Wall	19.0400		19.0400	0.1700	3.2368		(29a)
Roof - ceiling	29.4300		29.4300	0.1100	3.2373		(30)
Roof - pitch	14.9200		14.9200	0.2000	2.9840		(30)
Dormer Roof	3.6300		3.6300	0.2000	0.7260		(30)
Total net area of external elements Aum (A, m ²)			218.9500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5362		(33)
Party Wall			57.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	10.7900	0.0500	0.5395
E3 Sill	8.7500	0.0500	0.4375
E4 Jamb	24.9000	0.0500	1.2450
E5 Ground floor (normal)	18.8000	0.1600	3.0080
E6 Intermediate floor within a dwelling	18.6500	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.3800	0.0600	0.5628
E12 Gable (insulation at ceiling level)	6.8800	0.0600	0.4128
E16 Corner (normal)	21.0300	0.0900	1.8927
E18 Party wall between dwellings	9.8400	0.0600	0.5904
P1 Party wall - Ground floor	9.4200	0.0800	0.7536
P2 Party wall - Intermediate floor within a dwelling	13.9600	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.8800	0.1200	0.8256
E17 Corner (inverted - internal area greater than external area)	7.1600	-0.0900	-0.6444
E24 Eaves (insulation at ceiling level - inverted)	13.3000	0.2400	3.1920
E11 Eaves (insulation at rafter level)	4.6900	0.0400	0.1876
E13 Gable (insulation at rafter level)	6.8800	0.0800	0.5504
E18 Party wall between dwellings	9.2100	0.0600	0.5526
E25 Staggered party wall between dwellings	3.5800	0.0600	0.2148
P5 Party wall - Roof (insulation at rafter level)	3.4200	0.0800	0.2736
R1 Head of roof window	2.5000	0.0800	0.2000
R2 Sill of roof window	2.5000	0.0600	0.1500
R3 Jamb of roof window	4.8000	0.0800	0.3840
R5 Ridge (inverted)	4.6900	0.0400	0.1876
R6 Flat ceiling	17.2800	0.0600	1.0368
R7 Flat ceiling (inverted)	2.9000	0.0400	0.1160
R8 Roof to wall (rafter)	16.4500	0.0600	0.9870
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.6559 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	69.1921 (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	50.9868	50.7743	50.5659	49.5872	49.4041	48.5517	48.5517	48.3938	48.8800	49.4041	49.7745	50.1618 (38)
Average = Sum(39)m / 12 =	120.1789	119.9663	119.7580	118.7793	118.5962	117.7438	117.7438	117.5859	118.0721	118.5962	118.9666	119.3539 (39)
												118.7784
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0683	1.0664	1.0645	1.0558	1.0542	1.0466	1.0466	1.0452	1.0495	1.0542	1.0575	1.0609 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

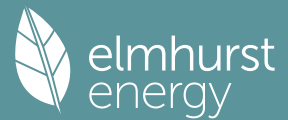
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8290 (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	30.9365	30.4770	29.8300	28.6371	27.7438	26.7533	26.2183	26.8608	27.5603	28.6202	29.8377	30.8319 (42b)
Hot water usage for other uses	43.6021	42.0165	40.4310	38.8455	37.2600	35.6744	35.6744	37.2600	38.8455	40.4310	42.0165	43.6021 (42c)
Average daily hot water use (litres/day)												68.3213 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	74.5386	72.4936	70.2611	67.4826	65.0038	62.4277	61.8927	64.1207	66.4058	69.0512	71.8543	74.4340 (44)
Energy content (annual)	118.0509	103.2299	107.9886	92.3803	87.5076	76.7622	74.8539	79.3949	81.8850	93.7018	102.3696	116.5456 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	100.3432	87.7454	91.7903	78.5232	74.3814	65.2479	63.6258	67.4856	69.6022	79.6466	87.0141	99.0638 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	100.3432	87.7454	91.7903	78.5232	74.3814	65.2479	63.6258	67.4856	69.6022	79.6466	87.0141	99.0638 (64)
12Total per year (kWh/year)												964.4697 (64)
Electric shower(s)	57.3824	51.1282	55.8300	53.2779	54.2776	51.7756	53.5014	54.2776	53.2779	55.8300	54.7802	57.3824 (64a)
Heat gains from water heating, kWh/month	39.4314	34.7184	36.9051	32.9503	32.1648	29.2559	29.2818	30.4408	30.7200	33.8691	35.4486	39.1115 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	153.6381	170.0993	153.6381	158.7594	153.6381	158.7594	153.6381	153.6381	158.7594	153.6381	158.7594	153.6381 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	275.1000	277.9547	270.7610	255.4465	236.1146	217.9454	205.8073	202.9526	210.1463	225.4608	244.7927	262.9619 (68)
Pumps, fans	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611 (71)
Total internal gains	52.9992	51.6643	49.6036	45.7643	43.2322	40.6331	39.3573	40.9151	42.6667	45.5230	49.2341	52.5693 (72)
	547.1727	565.1537	539.4381	525.4055	498.4203	482.7733	464.2381	462.9412	477.0078	490.0574	518.2216	534.6046 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.2200	10.6334	0.6300	0.7000	0.7700	23.4629 (74)			
East				1.4500	19.6403	0.6300	0.7000	0.7700	8.7034 (76)			
South				4.9800	46.7521	0.6300	0.7000	0.7700	71.1544 (78)			
Solar gains	103.3207	178.3970	252.6726	331.0482	389.8063	396.0408	378.0068	332.3277	279.2827	199.2683	124.1388	88.2010 (83)
Total gains	650.4934	743.5507	792.1107	856.4538	888.2266	878.8141	842.2449	795.2688	756.2905	689.3257	642.3604	622.8056 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.0029	26.0490	26.0943	26.3093	26.3499	26.5407	26.5407	26.5763	26.4669	26.3499	26.2679	26.1826
alpha	2.7335	2.7366	2.7396	2.7540	2.7567	2.7694	2.7694	2.7718	2.7645	2.7567	2.7512	2.7455
util living area	0.9685	0.9536	0.9331	0.8866	0.8075	0.6760	0.5417	0.5826	0.7610	0.9000	0.9533	0.9718 (86)
MIT	18.4312	18.7180	19.1370	19.7298	20.2768	20.7002	20.8838	20.8541	20.5509	19.8507	19.0500	18.3817 (87)
Th 2	20.0268	20.0284	20.0299	20.0371	20.0384	20.0447	20.0447	20.0458	20.0423	20.0384	20.0357	20.0329 (88)
util rest of house	0.9638	0.9468	0.9227	0.8676	0.7719	0.6110	0.4463	0.4894	0.7062	0.8796	0.9453	0.9677 (89)
MIT 2	17.6706	17.9546	18.3685	18.9507	19.4697	19.8490	19.9889	19.9716	19.7277	19.0765	18.2909	17.6256 (90)
Living area fraction	17.7821	18.0665	18.4812	19.0650	19.5881	19.9738	20.1201	20.1010	19.8484	19.1900	18.4023	17.7365 (91)
MIT	17.7821	18.0665	18.4812	19.0650	19.5881	19.9738	20.1201	20.1010	19.8484	19.1900	18.4023	17.7365 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7821	18.0665	18.4812	19.0650	19.5881	19.9738	20.1201	20.1010	19.8484	19.1900	18.4023	17.7365 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9489	0.9284	0.9013	0.8442	0.7525	0.6057	0.4544	0.4953	0.6935	0.8568	0.9270	0.9538 (94)
Useful gains	617.2625	690.2996	713.9524	723.0060	668.4182	532.2852	382.7379	393.8846	524.4694	590.6367	595.4651	594.0537 (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	1620.2685	1579.5419	1434.8484	1207.3904	935.4993	632.7313	414.4731	435.1864	678.7300	1018.7467	1344.5915	1615.6345 (97)
Space heating kWh	746.2365	597.5708	536.3467	348.7567	198.7083	0.0000	0.0000	0.0000	0.0000	318.5139	539.3710	760.0561 (98a)
Space heating requirement - total per year (kWh/year)												4045.5600
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	746.2365	597.5708	536.3467	348.7567	198.7083	0.0000	0.0000	0.0000	0.0000	318.5139	539.3710	760.0561 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4045.5600
Space heating per m2										(98c) / (4) =		35.9605 (99)

8c. Space cooling requirement

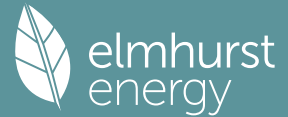
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1106.7914	871.3039	893.6529	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6779	0.7521	0.7217	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	750.2879	655.3300	644.9615	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	953.6561	914.2676	862.5287	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	146.4251	192.6496	161.8700	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	36.6063	48.1624	40.4675	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												125.2362 (107)
Energy for space heating												35.9605 (99)
Energy for space cooling												1.1132 (108)
Total												37.0737 (109)
Fabric Energy Efficiency (DFEE)												37.1 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.1800 (1b)	x	2.3100 (2b) = 102.0558 (1b) - (3b)
First floor	39.9600 (1c)	x	2.6100 (2c) = 104.2956 (1c) - (3c)
Second floor	28.3600 (1d)	x	2.4500 (2d) = 69.4820 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	275.8334 (5)

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2. Ventilation rate

											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)	
Number of blocked chimneys											0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										40.0000	/ (5) =	0.1450 (8)
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											5.0000 (17)		
Infiltration rate											0.3950 (18)		
Number of sides sheltered											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.3358 (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	0.4281	0.4197	0.4113	0.3693	0.3609	0.3190	0.3190	0.3106	0.3358	0.3609	0.3777	0.3945 (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	0.5916	0.5881	0.5846	0.5682	0.5651	0.5509	0.5509	0.5482	0.5564	0.5651	0.5713	0.5778 (25)	

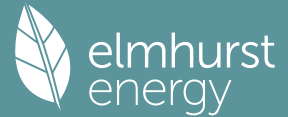
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			4.2800	1.0000	4.2800		(26)
TER Opening Type (Uw = 1.20)			13.6500	1.1450	15.6298		(27)
Ground Floor			44.1800	0.1300	5.7434		(28a)
External Wall	101.0000	14.9300	86.0700	0.1800	15.4926		(29a)
Dormer Cheeks	6.7500	3.0000	3.7500	0.1800	0.6750		(29a)
Stud Wall	19.0400		19.0400	0.1800	3.4272		(29a)
Roof - ceiling	29.4300		29.4300	0.1100	3.2373		(30)
Roof - pitch	14.9200		14.9200	0.1100	1.6412		(30)
Dormer Roof	3.6300		3.6300	0.1100	0.3993		(30)
Total net area of external elements Aum(A, m2)			218.9500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	50.5258		(33)
Party Wall			57.8100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.7900	0.0500	0.5395	
E3 Sill				8.7500	0.0500	0.4375	
E4 Jamb				24.9000	0.0500	1.2450	
E5 Ground floor (normal)				18.8000	0.1600	3.0080	
E6 Intermediate floor within a dwelling				18.6500	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				9.3800	0.0600	0.5628	
E12 Gable (insulation at ceiling level)				6.8800	0.0600	0.4128	
E16 Corner (normal)				21.0300	0.0900	1.8927	
E18 Party wall between dwellings				9.8400	0.0600	0.5904	
P1 Party wall - Ground floor				9.4200	0.0800	0.7536	
P2 Party wall - Intermediate floor within a dwelling				13.9600	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				6.8800	0.1200	0.8256	
E17 Corner (inverted - internal area greater than external area)				7.1600	-0.0900	-0.6444	
E24 Eaves (insulation at ceiling level - inverted)				13.3000	0.2400	3.1920	
E11 Eaves (insulation at rafter level)				4.6900	0.0400	0.1876	
E13 Gable (insulation at rafter level)				6.8800	0.0800	0.5504	
E18 Party wall between dwellings				9.2100	0.0600	0.5526	
E25 Staggered party wall between dwellings				3.5800	0.0600	0.2148	
P5 Party wall - Roof (insulation at rafter level)				3.4200	0.0800	0.2736	
R1 Head of roof window				2.5000	0.0800	0.2000	
R2 Sill of roof window				2.5000	0.0600	0.1500	
R3 Jamb of roof window				4.8000	0.0800	0.3840	
R5 Ridge (inverted)				4.6900	0.0400	0.1876	
R6 Flat ceiling				17.2800	0.0600	1.0368	
R7 Flat ceiling (inverted)				2.9000	0.0400	0.1160	
R8 Roof to wall (rafter)				16.4500	0.0600	0.9870	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.6559 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 68.1817 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8290 (42)
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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	30.9365	30.4770	29.8300	28.6371	27.7438	26.7533	26.2183	26.8608	27.5603	28.6202	29.8377	30.8319 (42b)
Hot water usage for other uses	43.6021	42.0165	40.4310	38.8455	37.2600	35.6744	35.6744	37.2600	38.8455	40.4310	42.0165	43.6021 (42c)
Average daily hot water use (litres/day)												68.3213 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	74.5386	72.4936	70.2611	67.4826	65.0038	62.4277	61.8927	64.1207	66.4058	69.0512	71.8543	74.4340 (44)
Distribution loss (46)m = 0.15 x (45)m	118.0509	103.2299	107.9886	92.3803	87.5076	76.7622	74.8539	79.3949	81.8850	93.7018	102.3696	116.5456 (45)
Total = Sum(45)m =	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1134.6702
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
WWHRS	100.3432	87.7454	91.7903	78.5232	74.3814	65.2479	63.6258	67.4856	69.6022	79.6466	87.0141	99.0638 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	100.3432	87.7454	91.7903	78.5232	74.3814	65.2479	63.6258	67.4856	69.6022	79.6466	87.0141	99.0638 (64)
Total per year (kWh/year)												964.4697 (64)
Electric shower(s)	57.3824	51.1282	55.8300	53.2779	54.2776	51.7756	53.5014	54.2776	53.2779	55.8300	54.7802	57.3824 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												652.7211 (64a)
Heat gains from water heating, kWh/month	39.4314	34.7184	36.9051	32.9503	32.1648	29.2559	29.2818	30.4408	30.7200	33.8691	35.4486	39.1115 (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	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6381	170.0993	153.6381	158.7594	153.6381	158.7594	153.6381	153.6381	158.7594	153.6381	158.7594	153.6381 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.1000	277.9547	270.7610	255.4465	236.1146	217.9454	205.8073	202.9526	210.1463	225.4608	244.7927	262.9619 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451 (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)	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611 (71)
Water heating gains (Table 5)	52.9992	51.6643	49.6036	45.7643	43.2322	40.6331	39.3573	40.9151	42.6667	45.5230	49.2341	52.5693 (72)
Total internal gains	547.1727	565.1537	539.4381	525.4055	498.4203	482.7733	464.2381	462.9412	477.0078	490.0574	518.2216	534.6046 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			7.2200		10.6334	0.6300		0.7000		0.7700		23.4629 (74)
East			1.4500		19.6403	0.6300		0.7000		0.7700		8.7034 (76)
South			4.9800		46.7521	0.6300		0.7000		0.7700		71.1544 (78)
Solar gains	103.3207	178.3970	252.6726	331.0482	389.8063	396.0408	378.0068	332.3277	279.2827	199.2683	124.1388	88.2010 (83)
Total gains	650.4934	743.5507	792.1107	856.4538	888.2266	878.8141	842.2449	795.2688	756.2905	689.3257	642.3604	622.8056 (84)

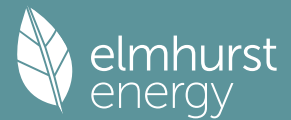
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	25.6074	25.6755	25.7427	26.0628	26.1236	26.4103	26.4103	26.4641	26.2992	26.1236	26.0009	25.8739
alpha	2.7072	2.7117	2.7162	2.7375	2.7416	2.7607	2.7607	2.7643	2.7533	2.7416	2.7334	2.7249
util living area	0.9686	0.9539	0.9337	0.8875	0.8090	0.6774	0.5433	0.5840	0.7624	0.9007	0.9535	0.9719 (86)
MIT	18.3889	18.6789	19.1034	19.7104	20.2638	20.6960	20.8818	20.8521	20.5442	19.8354	19.0262	18.3491 (87)
Th 2	20.0133	20.0157	20.0180	20.0289	20.0309	20.0404	20.0404	20.0422	20.0367	20.0309	20.0268	20.0225 (88)
util rest of house	0.9639	0.9471	0.9233	0.8685	0.7734	0.6122	0.4474	0.4904	0.7075	0.8803	0.9455	0.9677 (89)
MIT 2	17.6199	17.9076	18.3276	18.9263	19.4522	19.8421	19.9837	19.9669	19.7176	19.0566	18.2616	17.5865 (90)
Living area fraction	17.7327	18.0207	18.4414	19.0413	19.5713	19.9673	20.1154	20.0967	19.8389	19.1708	18.3737	17.6983 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7327	18.0207	18.4414	19.0413	19.5713	19.9673	20.1154	20.0967	19.8389	19.1708	18.3737	17.6983 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9489	0.9286	0.9018	0.8449	0.7537	0.6067	0.4555	0.4962	0.6945	0.8574	0.9271	0.9538 (94)
Ext temp.	617.2756	690.4421	714.2876	723.6016	669.4830	533.2079	383.6610	394.6341	525.2812	591.0020	595.5547	594.0475 (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)

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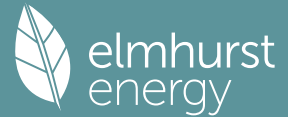
Space heating kWh	1639.2626	1596.9385	1449.6128	1215.9701	941.5909	635.0866	415.9604	436.5276	681.9220	1025.2714	1354.9655	1630.3040	(97)
Space heating requirement - total per year (kWh/year)	760.3584	609.1656	547.0819	354.5053	202.4483	0.0000	0.0000	0.0000	0.0000	323.0964	546.7758	770.9748	(98a)
Solar heating kWh												4114.4065	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh												0.0000	
Space heating requirement after solar contribution - total per year (kWh/year)	760.3584	609.1656	547.0819	354.5053	202.4483	0.0000	0.0000	0.0000	0.0000	323.0964	546.7758	770.9748	(98c)
Space heating per m2												4114.4065	
												36.5725	(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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1112.2535	875.6039	897.4409	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6754	0.7497	0.7196	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	751.2196	656.4782	645.8084	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh						953.6561	914.2676	862.5287	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	145.7543	191.7953	161.2399	0.0000	0.0000	0.0000	0.0000	(104)
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	(105)
Space cooling kWh						36.4386	47.9488	40.3100	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												124.6974	(107)
Energy for space heating												36.5725	(99)
Energy for space cooling												1.1084	(108)
Total												37.6809	(109)
Fabric Energy Efficiency (TFEE)												37.7	(109)

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Property Reference	OP-D320 A4HAWT				Issued on Date	29/11/2024	
Assessment Reference	A4HAWT		Prop Type Ref	A4HAWT			
Property	A4HAWT						
SAP Rating	81 B	DER	4.01	TER	10.85		
Environmental	96 A	% DER < TER				63.04	
CO ₂ Emissions (t/year)	0.42	DFEE	37.07	TFEE	37.68		
Compliance Check	See BREL	% DFEE < TFEE				1.61	
% DPER < TPER	25.48	DPER	42.34	TPER	56.81		
Assessor Details	Mr. Matthew Stainrod				Assessor ID	AU83-0001	
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)
Ground floor	44.1800 (1b)	x 2.3100 (2b)	= 102.0558 (1b) - (3b)
First floor	39.9600 (1c)	x 2.6100 (2c)	= 104.2956 (1c) - (3c)
Second floor	28.3600 (1d)	x 2.4500 (2d)	= 69.4820 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.8334 (5)

2. Ventilation rate

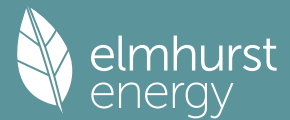
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.5000 (17)
Infiltration rate	0.1750 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1487 (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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3297	0.3259	0.3222	0.3036	0.2999	0.2813	0.2813	0.2776	0.2888	0.2999	0.3073	0.3148 (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
Front Door			4.2800	1.0000	4.2800		(26)
Windows (Uw = 1.30)			13.6500	1.2357	16.8679		(27)
Ground Floor			44.1800	0.1100	4.8598		(28a)
External Wall	101.0000	14.9300	86.0700	0.1700	14.6319		(29a)
Dormer Cheeks	6.7500	3.0000	3.7500	0.1900	0.7125		(29a)
Stud Wall	19.0400		19.0400	0.1700	3.2368		(29a)
Roof - ceiling	29.4300		29.4300	0.1100	3.2373		(30)
Roof - pitch	14.9200		14.9200	0.2000	2.9840		(30)
Dormer Roof	3.6300		3.6300	0.2000	0.7260		(30)
Total net area of external elements Aum(A, m ²)			218.9500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5362		(33)
Party Wall			57.8100	0.0000	0.0000		(32)

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

100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	10.7900	0.0500	0.5395
E2 Other lintels (including other steel lintels)	8.7500	0.0500	0.4375
E3 Sill	24.9000	0.0500	1.2450
E4 Jamb	18.8000	0.1600	3.0080
E5 Ground floor (normal)	18.6500	0.0000	0.0000
E6 Intermediate floor within a dwelling	9.3800	0.0600	0.5628
E10 Eaves (insulation at ceiling level)	6.8800	0.0600	0.4128
E12 Gable (insulation at ceiling level)	21.0300	0.0900	1.8927
E16 Corner (normal)	9.8400	0.0600	0.5904
E18 Party wall between dwellings	9.4200	0.0800	0.7536
P1 Party wall - Ground floor	13.9600	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	6.8800	0.1200	0.8256
P4 Party wall - Roof (insulation at ceiling level)	7.1600	-0.0900	-0.6444
E17 Corner (inverted - internal area greater than external area)	13.3000	0.2400	3.1920
E24 Eaves (insulation at ceiling level - inverted)	4.6900	0.0400	0.1876
E11 Eaves (insulation at rafter level)	6.8800	0.0800	0.5504
E13 Gable (insulation at rafter level)	9.2100	0.0600	0.5526
E18 Party wall between dwellings	3.5800	0.0600	0.2148
E25 Staggered party wall between dwellings	3.4200	0.0800	0.2736
P5 Party wall - Roof (insulation at rafter level)	2.5000	0.0800	0.2000
R1 Head of roof window	2.5000	0.0600	0.1500
R2 Sill of roof window	4.8000	0.0800	0.3840
R3 Jamb of roof window	4.6900	0.0400	0.1876
R5 Ridge (inverted)	17.2800	0.0600	1.0368
R6 Flat ceiling	2.9000	0.0400	0.1160
R7 Flat ceiling (inverted)	16.4500	0.0600	0.9870
R8 Roof to wall (rafter)			

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

17.6559 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.1921 (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	30.0070	29.6685	29.3300	27.6375	27.2990	25.6065	25.6065	25.2680	26.2835	27.2990	27.9760	28.6530
Heat transfer coeff	99.1990	98.8605	98.5220	96.8295	96.4910	94.7985	94.7985	94.4600	95.4755	96.4910	97.1680	97.8450
Average = Sum(39)m / 12 =												96.7449

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8818	0.8788	0.8758	0.8607	0.8577	0.8427	0.8427	0.8396	0.8487	0.8577	0.8637	0.8697
HLP (average)												0.8600
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

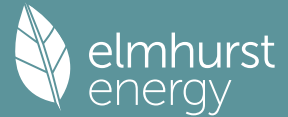
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8290 (42)
Hot water usage for mixer showers	98.5233	97.0427	94.8851	90.7571	87.7107	84.3133	82.3823	84.5235	86.8707	90.5184	94.7351	98.1458 (42a)
Hot water usage for baths	32.5647	32.0811	31.4000	30.1443	29.2040	28.1614	27.5982	28.2745	29.0109	30.1265	31.4081	32.4546 (42b)
Hot water usage for other uses	45.8969	44.2279	42.5590	40.8900	39.2210	37.5520	37.5520	39.2210	40.8900	42.5590	44.2279	45.8969 (42c)
Average daily hot water use (litres/day)												162.7523 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	176.9850	173.3517	168.8442	161.7914	156.1357	150.0268	147.5325	152.0190	156.7715	163.2039	170.3712	176.4974 (44)
Energy content (annual)	280.3009	246.8506	259.5072	221.4843	210.1886	184.4754	178.4278	188.2313	193.3150	221.4661	242.7250	276.3523 (45)
Distribution loss (46)m = 0.15 x (45)m	42.0451	37.0276	38.9261	33.2226	31.5283	27.6713	26.7642	28.2347	28.9972	33.2199	36.4087	41.4528 (46)
Water storage loss:												
Store volume												230.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.4040 (55)
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	378.6825	335.7114	357.8888	316.6923	308.5702	249.1074	245.2142	255.0177	257.9470	319.8477	337.9330	374.7339 (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	378.6825	335.7114	357.8888	316.6923	308.5702	249.1074	245.2142	255.0177	257.9470	319.8477	337.9330	374.7339 (64)
12Total per year (kWh/year)												3737.3460 (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	137.0861	121.7169	130.1722	116.1139	113.7738	79.3477	77.9372	81.1968	82.2868	117.5236	123.1765	135.7732 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6381	170.0993	153.6381	158.7594	153.6381	158.7594	153.6381	158.7594	153.6381	158.7594	153.6381	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.1000	277.9547	270.7610	255.4465	236.1146	217.9454	205.8073	202.9526	210.1463	225.4608	244.7927	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Losses e.g. evaporation (negative values) (Table 5)	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	
Water heating gains (Table 5)												

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Total internal gains	184.2556	181.1263	174.9627	161.2693	152.9218	110.2051	104.7543	109.1355	114.2873	157.9618	171.0784	182.4909 (72)
	678.4291	694.6157	664.7972	640.9106	608.1099	552.3453	529.6351	531.1616	548.6283	602.4961	640.0659	664.5262 (73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d	Gains W
North	7.2200				10.6334		0.6300		0.7000		0.7700	23.4629 (74)
East	1.4500				19.6403		0.6300		0.7000		0.7700	8.7034 (76)
South	4.9800				46.7521		0.6300		0.7000		0.7700	71.1544 (78)
Solar gains	103.3207	178.3970	252.6726	331.0482	389.8063	396.0408	378.0068	332.3277	279.2827	199.2683	124.1388	88.2010 (83)
Total gains	781.7497	873.0127	917.4698	971.9588	997.9162	948.3861	907.6419	863.4893	827.9111	801.7645	764.2046	752.7272 (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	31.5023	31.6102	31.7188	32.2732	32.3864	32.9646	32.9646	33.0828	32.7309	32.3864	32.1608	31.9383
alpha	3.1002	3.1073	3.1146	3.1515	3.1591	3.1976	3.1976	3.2055	3.1821	3.1591	3.1441	3.1292
util living area	0.9460	0.9237	0.8925	0.8247	0.7178	0.5745	0.4381	0.4739	0.6681	0.8370	0.9200	0.9510 (86)
Living	19.1674	19.4289	19.7788	20.2545	20.6348	20.8745	20.9604	20.9486	20.7861	20.3295	19.6969	19.1370
Non living	18.0255	18.3551	18.7944	19.3875	19.8384	20.1112	20.1914	20.1849	20.0201	19.4890	18.7050	17.9940
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	20.0625	19.4289	19.7788	20.2545	20.6348	20.8745	20.9604	20.9486	20.7861	20.3295	19.6969	19.3976 (87)
Th 2	20.1830	20.1856	20.1882	20.2010	20.2036	20.2165	20.2165	20.2191	20.2113	20.2036	20.1985	20.1933 (88)
util rest of house	0.9392	0.9142	0.8789	0.8021	0.6808	0.5188	0.3671	0.4026	0.6158	0.8114	0.9086	0.9448 (89)
MIT 2	19.3229	18.3551	18.7944	19.3875	19.8384	20.1112	20.1914	20.1849	20.0201	19.4890	18.7050	18.3903 (90)
Living area fraction	19.4314	18.5126	18.9388	19.5146	19.9552	20.2232	20.3042	20.2969	20.1325	19.6123	18.8505	0.1467 (91)
MIT	19.4314	18.5126	18.9388	19.5146	19.9552	20.2232	20.3042	20.2969	20.1325	19.6123	18.8505	18.5381 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4314	18.5126	18.9388	19.5146	19.9552	20.2232	20.3042	20.2969	20.1325	19.6123	18.8505	18.5381 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9319	0.8898	0.8534	0.7799	0.6683	0.5193	0.3753	0.4099	0.6102	0.7895	0.8846	0.9285 (94)
Useful gains	728.5076	776.8291	783.0012	758.0225	666.9107	492.4574	340.6227	353.9785	505.2031	632.9595	675.9784	698.8907 (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	1501.0185	1345.7509	1225.4981	1027.8108	796.5520	533.0675	351.1523	368.1003	575.9547	869.6052	1141.7697	1402.9092 (97)
Space heating kWh	574.7482	382.3155	329.2177	194.2476	96.4531	0.0000	0.0000	0.0000	0.0000	176.0644	335.3697	523.7898 (98a)
Space heating requirement - total per year (kWh/year)												2612.2059
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	574.7482	382.3155	329.2177	194.2476	96.4531	0.0000	0.0000	0.0000	0.0000	176.0644	335.3697	523.7898 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2612.2059
Space heating per m2										(98c) / (4) =		23.2196 (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 %)												251.7125 (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	574.7482	382.3155	329.2177	194.2476	96.4531	0.0000	0.0000	0.0000	0.0000	176.0644	335.3697	523.7898 (98)
Space heating efficiency (main heating system 1)	251.7125	251.7125	251.7125	251.7125	251.7125	0.0000	0.0000	0.0000	0.0000	251.7125	251.7125	251.7125 (210)
Space heating fuel (main heating system)	228.3351	151.8858	130.7911	77.1704	38.3187	0.0000	0.0000	0.0000	0.0000	69.9466	133.2352	208.0904 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	378.6825	335.7114	357.8888	316.6923	308.5702	249.1074	245.2142	255.0177	257.9470	319.8477	337.9330	374.7339 (64)
Efficiency of water heater (217)m	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222	269.4222 (216)
Fuel for water heating, kWh/month	140.5536	124.6042	132.8357	117.5450	114.5304	92.4598	91.0148	94.6535	95.7408	118.7161	125.4288	139.0879 (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	34.8115	31.4426	34.8115	33.6886	34.8115	33.6886	34.8115	34.8115	33.6886	34.8115	33.6886	34.8115 (231)
Lighting	31.9230	25.6098	23.0588	16.8938	13.0493	10.6614	11.9040	15.4733	20.0982	26.3700	29.7848	32.8102 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1037.7734	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												269.4222	
Water heating fuel used												1387.1706	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2180)													
mechanical ventilation fans (SFP = 1.2180)												409.8774	(230a)
Total electricity for the above, kWh/year												409.8774	(231)
Electricity for lighting (calculated in Appendix L)												257.6366	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3092.4580	(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	1037.7734	0.1553	161.1748	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1387.1706	0.1415	196.3336	(264)
Space and water heating			357.5084	(265)
Pumps, fans and electric keep-hot	409.8774	0.1387	56.8550	(267)
Energy for lighting	257.6366	0.1443	37.1849	(268)
Total CO2, kg/year			451.5484	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0100	(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	1037.7734	1.5749	1634.4353	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1387.1706	1.5234	2113.2016	(278)
Space and water heating			3747.6369	(279)
Pumps, fans and electric keep-hot	409.8774	1.5128	620.0625	(281)
Energy for lighting	257.6366	1.5338	395.1716	(282)
Total Primary energy kWh/year			4762.8710	(286)
Dwelling Primary energy Rate (DPER)			42.3400	(287)

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

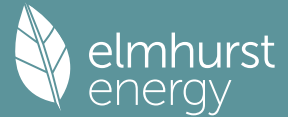
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.1800 (1b)	x	2.3100 (2b)	=	102.0558 (1b)	- (3b)
First floor	39.9600 (1c)	x	2.6100 (2c)	=	104.2956 (1c)	- (3c)
Second floor	28.3600 (1d)	x	2.4500 (2d)	=	69.4820 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	112.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	=	275.8334	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1450 (8)

Pressure test Yes

Pressure Test Method Blower Door

Measured/design AP50 5.0000 (17)

Infiltration rate 0.3950 (18)

Number of sides sheltered 2 (19)

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

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3358 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4281	0.4197	0.4113	0.3693	0.3609	0.3190	0.3190	0.3106	0.3358	0.3609	0.3777	0.3945	(22b)
	0.5916	0.5881	0.5846	0.5682	0.5651	0.5509	0.5509	0.5482	0.5564	0.5651	0.5713	0.5778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			4.2800	1.0000	4.2800			(26)
TER Opening Type (Uw = 1.20)			13.6500	1.1450	15.6298			(27)
Ground Floor			44.1800	0.1300	5.7434			(28a)
External Wall	101.0000	14.9300	86.0700	0.1800	15.4926			(29a)
Dormer Cheeks	6.7500	3.0000	3.7500	0.1800	0.6750			(29a)
Stud Wall	19.0400		19.0400	0.1800	3.4272			(29a)
Roof - ceiling	29.4300		29.4300	0.1100	3.2373			(30)
Roof - pitch	14.9200		14.9200	0.1100	1.6412			(30)
Dormer Roof	3.6300		3.6300	0.1100	0.3993			(30)
Total net area of external elements Aum(A, m2)			218.9500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 50.5258			(33)
Party Wall			57.8100	0.0000	0.0000			(32)

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

100.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	10.7900	0.0500	0.5395	
E3 Sill	8.7500	0.0500	0.4375	
E4 Jamb	24.9000	0.0500	1.2450	
E5 Ground floor (normal)	18.8000	0.1600	3.0080	
E6 Intermediate floor within a dwelling	18.6500	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	9.3800	0.0600	0.5628	
E12 Gable (insulation at ceiling level)	6.8800	0.0600	0.4128	
E16 Corner (normal)	21.0300	0.0900	1.8927	
E18 Party wall between dwellings	9.8400	0.0600	0.5904	
P1 Party wall - Ground floor	9.4200	0.0800	0.7536	
P2 Party wall - Intermediate floor within a dwelling	13.9600	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	6.8800	0.1200	0.8256	
E17 Corner (inverted - internal area greater than external area)	7.1600	-0.0900	-0.6444	
E24 Eaves (insulation at ceiling level - inverted)	13.3000	0.2400	3.1920	
E11 Eaves (insulation at rafter level)	4.6900	0.0400	0.1876	
E13 Gable (insulation at rafter level)	6.8800	0.0800	0.5504	
E18 Party wall between dwellings	9.2100	0.0600	0.5526	
E25 Staggered party wall between dwellings	3.5800	0.0600	0.2148	
P5 Party wall - Roof (insulation at rafter level)	3.4200	0.0800	0.2736	
R1 Head of roof window	2.5000	0.0800	0.2000	
R2 Sill of roof window	2.5000	0.0600	0.1500	
R3 Jamb of roof window	4.8000	0.0800	0.3840	
R5 Ridge (inverted)	4.6900	0.0400	0.1876	
R6 Flat ceiling	17.2800	0.0600	1.0368	
R7 Flat ceiling (inverted)	2.9000	0.0400	0.1160	
R8 Roof to wall (rafter)	16.4500	0.0600	0.9870	

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

17.6559 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 68.1817 (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	53.8535	53.5296	53.2121	51.7209	51.4419	50.1432	50.1432	49.9027	50.6434	51.4419	52.0063	52.5964	(38)
Heat transfer coeff	122.0351	121.7113	121.3938	119.9026	119.6236	118.3248	118.3248	118.0843	118.8251	119.6236	120.1880	120.7781	(39)
Average = Sum(39)m / 12 =												119.9013	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0848	1.0819	1.0791	1.0658	1.0633	1.0518	1.0518	1.0496	1.0562	1.0633	1.0683	1.0736	(40)
HLP (average)												1.0658	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8290 (42)
Hot water usage for mixer showers													
71.6533	70.5765	69.0074	66.0052	63.7896	61.3188	59.9144	61.4716	63.1787	65.8315	68.8983	71.3788	71.3788	(42a)
Hot water usage for baths													
30.9365	30.4770	29.8300	28.6371	27.7438	26.7533	26.2183	26.8608	27.5603	28.6202	29.8377	30.8319	30.8319	(42b)
Hot water usage for other uses													
43.6021	42.0165	40.4310	38.8455	37.2600	35.6744	35.6744	37.2600	38.8455	40.4310	42.0165	43.6021	43.6021	(42c)
Average daily hot water use (litres/day)													134.3832 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1919	143.0701	139.2684	133.4877	128.7933	123.7465	121.8071	125.5924	129.5845	134.8827	140.7525	145.8128	(44)
Energy conte	231.5322	203.7299	214.0504	182.7380	173.3806	152.1608	147.3152	155.5096	159.7906	183.0346	200.5278	228.3076	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													2232.0773
34.7298	30.5595	32.1076	27.4107	26.0071	22.8241	22.0973	23.3264	23.9686	27.4552	30.0792	34.2461	34.2461	(46)
Water storage loss:													
Store volume													230.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7973 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9706 (55)

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Total storage loss	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872 (56)
If cylinder contains dedicated solar storage	30.0872	27.1756	30.0872	29.1167	30.0872	29.1167	30.0872	30.0872	29.1167	30.0872	29.1167	30.0872 (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	284.8818	251.9167	267.4000	234.3667	226.7302	203.7895	200.6648	208.8592	211.4193	236.3842	252.1564	281.6572 (62)
WWHRS	-32.7569	-28.9705	-30.3362	-25.1196	-23.4105	-20.0326	-18.7773	-19.9678	-20.7265	-24.4342	-27.6810	-32.1503 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.1249	222.9462	237.0638	209.2471	203.3197	183.7569	181.8874	188.8914	190.6928	211.9500	224.4754	249.5069 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2555.8626 (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	119.6642	106.2896	113.8515	102.0633	100.3287	91.8964	91.6620	94.3866	94.4333	103.5387	107.9784	118.5920 (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	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	141.4514	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6381	170.0993	153.6381	158.7594	153.6381	158.7594	153.6381	153.6381	158.7594	153.6381	158.7594	153.6381	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.1000	277.9547	270.7610	255.4465	236.1146	217.9454	205.8073	202.9526	210.1463	225.4608	244.7927	262.9619	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	37.1451	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	-113.1611	(71)
Water heating gains (Table 5)	160.8389	158.1690	153.0262	141.7546	134.8505	127.6339	123.2016	126.8638	131.1574	139.1649	149.9700	159.3978	(72)
Total internal gains	658.0124	674.6585	645.8607	624.3959	593.0386	569.7741	548.0824	548.8899	565.4985	586.6993	621.9575	644.4332	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					7.2200	10.6334	0.6300	0.7000			0.7700	23.4629 (74)	
East					1.4500	19.6403	0.6300	0.7000			0.7700	8.7034 (76)	
South					4.9800	46.7521	0.6300	0.7000			0.7700	71.1544 (78)	
Solar gains	103.3207	178.3970	252.6726	331.0482	389.8063	396.0408	378.0068	332.3277	279.2827	199.2683	124.1388	88.2010	(83)
Total gains	761.3331	853.0554	898.5333	955.4441	982.8449	965.8148	926.0892	881.2175	844.7812	785.9676	746.0963	732.6342	(84)

7. Mean internal temperature (heating season)

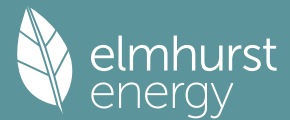
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.6074	25.6755	25.7427	26.0628	26.1236	26.4103	26.4103	26.4641	26.2992	26.1236	26.0009	25.8739	
alpha	2.7072	2.7117	2.7162	2.7375	2.7416	2.7607	2.7607	2.7643	2.7533	2.7416	2.7334	2.7249	
util living area	0.9553	0.9380	0.9141	0.8623	0.7763	0.6398	0.5055	0.5424	0.7225	0.8726	0.9357	0.9593	(86)
MIT	18.5692	18.8476	19.2554	19.8294	20.3469	20.7385	20.9015	20.8775	20.6074	19.9568	19.1859	18.5306	(87)
Th 2	20.0133	20.0157	20.0180	20.0289	20.0309	20.0404	20.0404	20.0422	20.0367	20.0309	20.0268	20.0225	(88)
util rest of house	0.9489	0.9292	0.9014	0.8404	0.7378	0.5738	0.4129	0.4512	0.6645	0.8481	0.9252	0.9535	(89)
MIT 2	17.1691	17.5213	18.0362	18.7557	19.3800	19.8249	19.9809	19.9639	19.6904	18.9241	17.9601	17.1256	(90)
Living area fraction	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(91)
MIT	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(92)
Temperature adjustment	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(93)
adjusted MIT	17.3745	17.7158	18.2150	18.9131	19.5218	19.9589	20.1159	20.0979	19.8249	19.0755	18.1399	17.3317	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9246	0.9013	0.8707	0.8097	0.7145	0.5677	0.4206	0.4569	0.6500	0.8179	0.8973	0.9305	(94)
Ext temp.	703.9292	768.8523	782.3944	773.6059	702.2097	548.2990	389.5593	402.6107	549.1238	642.8667	669.4736	681.7133	(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	1595.5430	1559.8278	1422.1254	1200.6019	935.6743	634.0867	416.0207	436.6593	680.2579	1013.8723	1326.8632	1586.0185	(97)
Space heating requirement - total per year (kWh/year)	663.3607	531.5356	475.9599	307.4371	173.6977	0.0000	0.0000	0.0000	0.0000	276.0282	473.3205	672.8031	(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)	663.3607	531.5356	475.9599	307.4371	173.6977	0.0000	0.0000	0.0000	0.0000	276.0282	473.3205	672.8031	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3574.1427												
Space heating per m2	(98c) / (4) =											31.7702	(99)

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

Full SAP Calculation Printout



Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	663.3607	531.5356	475.9599	307.4371	173.6977	0.0000	0.0000	0.0000	0.0000	276.0282	473.3205	672.8031 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	718.7006	575.8782	515.6662	333.0846	188.1882	0.0000	0.0000	0.0000	0.0000	299.0555	512.8066	728.9308 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.1249	222.9462	237.0638	209.2471	203.3197	183.7569	181.8874	188.8914	190.6928	211.9500	224.4754	249.5069 (64)
Efficiency of water heater	86.1249	85.9360	85.5906	84.9213	83.7087	79.8000	79.8000	79.8000	79.8000	84.6532	85.6910	79.8000 (216)
Fuel for water heating, kWh/month	292.7432	259.4327	276.9742	246.4013	242.8895	230.2718	227.9291	236.7060	238.9634	250.3746	261.9590	289.5489 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	31.9230	25.6098	23.0588	16.8938	13.0493	10.6614	11.9040	15.4733	20.0982	26.3700	29.7848	32.8102 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-42.2754	-60.0794	-87.0122	-98.5537	-106.8223	-99.8442	-98.5750	-92.7889	-82.6715	-69.0076	-46.6344	-36.4906 (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)	-22.4128	-47.3242	-94.4081	-142.3170	-188.7130	-189.8588	-187.6623	-158.6739	-115.9876	-67.8920	-29.9895	-17.7130 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3872.3106 (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												3054.1938 (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)												257.6366 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-2183.7072 (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												5086.4338 (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	3872.3106	0.2100	813.1852 (261)									
Total CO2 associated with community systems			0.0000 (373)									
Water heating (other fuel)	3054.1938	0.2100	641.3807 (264)									
Space and water heating			1454.5659 (265)									
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)									
Energy for lighting	257.6366	0.1443	37.1849 (268)									
Energy saving/generation technologies												
PV Unit electricity used in dwelling	-920.7551	0.1344	-123.7864									
PV Unit electricity exported	-1262.9521	0.1258	-158.8564									
Total			-282.6428 (269)									
Total CO2, kg/year			1221.0373 (272)									
EPC Target Carbon Dioxide Emission Rate (TER)			10.8500 (273)									
13a. Primary energy - Individual heating systems including micro-CHP												
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year									
Space heating - main system 1	3872.3106	1.1300	4375.7110 (275)									
Total CO2 associated with community systems			0.0000 (473)									
Water heating (other fuel)	3054.1938	1.1300	3451.2390 (278)									
Space and water heating			7826.9500 (279)									
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)									
Energy for lighting	257.6366	1.5338	395.1716 (282)									
Energy saving/generation technologies												
PV Unit electricity used in dwelling	-920.7551	1.4969	-1378.2413									
PV Unit electricity exported	-1262.9521	0.4617	-583.1049									
Total			-1961.3461 (283)									
Total Primary energy kWh/year			6390.8762 (286)									
Target Primary Energy Rate (TPER)			56.8100 (287)									

