

Full SAP Calculation Printout



Property Reference	BE15513		Issued on Date	17/04/2023	
Assessment Reference	As Designed	Prop Type Ref	New Dwelling		
Property	Highfields, Whempstead Road, Whempstead, SG12 0PG				
SAP Rating	81 B	DER	3.06	TER	9.50
Environmental	96 A	% DER < TER			67.79
CO ₂ Emissions (t/year)	2.73	DFEE	44.13	TFEE	46.78
Compliance Check	See BREL	% DFEE < TFEE			5.65
% DPER < TPER	37.20	DPER	31.75	TPER	50.55
Assessor Details	Mr. Matthew Ray			Assessor ID	T806-0001
Client	Alp Arikoglu, Alp Arikoglu				

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)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2983.8452 (5)
Dwelling volume			

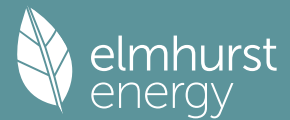
2. Ventilation rate

	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	3.0000 (17)												
Infiltration rate	0.1500 (18)												
Number of sides sheltered	0 (19)												
Shelter factor	(20) = 1 - [0.075 x (19)] =											1.0000 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1500 (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)
Mechanical extract ventilation - centralised	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)
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)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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
Solid Door			2.1000	1.8000	3.7800		(26)

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Half-glazed Door			10.7200	1.4000	15.0080								(26a)
Windows (Uw = 1.20)			36.9800	1.1450	42.3435								(27)
French Doors (Uw = 1.40)			22.9900	1.3258	30.4792								(27)
Bi-folding Doors (Uw = 1.40)			26.7900	1.3258	35.5170								(27)
Roof Window			1.4400	1.1450	1.6489								(27a)
Roof Window			1.4400	1.1450	1.6489								(27a)
Roof Window			0.8500	1.1450	0.9733								(27a)
Basement Floor			209.5000	0.1200	25.1400	110.0000	23045.0000						(28)
Ground Floor			103.8300	0.1400	14.5362	75.0000	7787.2500						(28a)
Basement Wall	184.6500		184.6500	0.1700	31.3905	9.0000	1661.8500						(29a)
External Wall	611.6400	99.5800	512.0600	0.1200	61.4472	60.0000	30723.6000						(29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1300	41.1125	9.0000	2846.2500						(30)
Balcony Flat Roof	11.8700		11.8700	0.1300	1.5431	9.0000	106.8300						(30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1200	10.1124	9.0000	758.4300						(30)
Total net area of external elements Aum(A, m2)			1525.7400										(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	316.6806								(33)
Internal Wall - Masonry			615.1800			75.0000	46138.5000						(32c)
Internal Wall - Timber			642.0600			9.0000	5778.5400						(32c)
Internal Floor - 2F/1F			209.5000			18.0000	3771.0000						(32d)
Internal Floor - 1F/GF			190.9500			18.0000	3437.1000						(32d)
Internal Ceiling - GF/1F			209.5000			9.0000	1885.5000						(32e)
Internal Ceiling - 1F/2F			209.5000			9.0000	1885.5000						(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 129825.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0240	1.2382
E3 Sill	45.6200	0.0270	1.2317
E4 Jamb	137.2600	0.0410	5.6277
R1 Head of roof window	3.0500	0.2400	0.7320
R2 Sill of roof window	3.0500	0.2400	0.7320
R3 Jamb of roof window	7.4000	0.2400	1.7760
E5 Ground floor (normal)	105.3000	0.0560	5.8968
E22 Basement floor	61.5500	0.2200	13.5410
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.1000	0.8500
E11 Eaves (insulation at rafter level)	92.5500	0.0070	0.6479
E13 Gable (insulation at rafter level)	24.1000	0.0530	1.2773
E14 Flat roof	13.8000	0.1600	2.2080
E16 Corner (normal)	109.4400	0.0410	4.4870
E17 Corner (inverted - internal area greater than external area)	70.4800	-0.0570	-4.0174
R6 Flat ceiling	37.2000	0.1200	4.4640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 40.6922 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 357.3728 (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	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345
Average = Sum(39)m / 12 =	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.9663 (42)

Hot water usage for mixer showers	124.7429	122.8682	120.1365	114.9099	111.0527	106.7513	104.3063	107.0174	109.9892	114.6076	119.9466	124.2649
Hot water usage for baths	39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044
Hot water usage for other uses	55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490
Average daily hot water use (litres/day)												201.5210

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	219.1285	214.6636	209.1043	200.3595	193.3632	185.7997	182.6779	188.2108	194.0766	202.0449	210.9331	218.5183
Distribution loss (46)m = 0.15 x (45)m	347.0461	305.6781	321.3856	274.2821	260.3041	228.4624	220.9331	233.0442	239.3159	274.1730	300.5129	342.1468
Total = Sum(45)m =												3347.2843

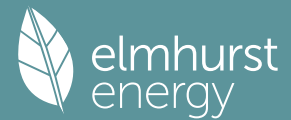
Water storage loss: 52.0569 45.8517 48.2078 41.1423 39.0456 34.2694 33.1400 34.9566 35.8974 41.1260 45.0769 51.3220 (46)

Store volume 500.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.1500 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 0.6210 (55)

Primary loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510
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
Total heat required for water heating calculated for each month	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	384.6602	(64)
	Total per year (kWh/year) = Sum(64)m =												3847.8453	(64)
12Total per year (kWh/year)													3848	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	149.4035	132.3573	140.8714	124.1124	120.5618	108.8773	107.4710	111.4979	112.4861	125.1733	132.8341	147.7745	147.7745	(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	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	514.9815	570.1581	514.9815	532.1476	514.9815	532.1476	514.9815	514.9815	532.1476	514.9815	532.1476	514.9815	514.9815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	878.3863	887.5012	864.5319	815.6331	753.9071	695.8934	657.1366	648.0217	670.9910	719.8898	781.6158	839.6295	839.6295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	(71)
Water heating gains (Table 5)	200.8112	196.9603	189.3433	172.3783	162.0455	151.2185	144.4502	149.8628	156.2307	168.2436	184.4919	198.6217	198.6217	(72)
Total internal gains	1676.6736	1737.1142	1651.3514	1602.6536	1513.4287	1461.7541	1399.0630	1395.3607	1441.8639	1485.6096	1580.7499	1635.7274	1635.7274	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.4000	10.6334	0.6300	0.7000	0.7700	17.5484 (74)
East	12.4200	19.6403	0.6300	0.7000	0.7700	74.5488 (76)
South	11.0600	46.7521	0.6300	0.7000	0.7700	158.0257 (78)
West	8.1000	19.6403	0.6300	0.7000	0.7700	48.6188 (80)
North	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
East	0.8500	26.0000	0.6300	0.7000	1.0000	8.7715 (82)
South	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
North	9.6000	10.6334	0.6300	0.7000	0.7700	31.1971 (74)
West	13.3900	19.6403	0.6300	0.7000	0.7700	80.3711 (80)
North	26.7900	10.6334	0.6300	0.7000	0.7700	87.0595 (74)

Solar gains	535.8608	996.4443	1568.5205	2259.3645	2798.7720	2891.0554	2740.8573	2324.8068	1807.4938	1158.2480	657.4906	448.2321	448.2321	(83)
Total gains	2212.5344	2733.5585	3219.8719	3862.0181	4312.2007	4352.8095	4139.9204	3720.1675	3249.3578	2643.8576	2238.2405	2083.9595	2083.9595	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	
alpha	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	
util living area	0.9993	0.9983	0.9957	0.9852	0.9528	0.8708	0.7507	0.8121	0.9506	0.9931	0.9986	0.9995	0.9995	(86)
Living	19.2157	19.3619	19.6231	19.9983	20.3799	20.6851	20.8297	20.7932	20.5249	20.0360	19.5575	19.1854	19.1854	
Non living	18.0054	18.1929	18.5276	19.0069	19.4879	19.8541	20.0046	19.9735	19.6727	19.0570	18.4439	17.9665	17.9665	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	27	0	0	0	0	0	0	0	0	0	0	20	20	
MIT	20.1198	19.3619	19.6231	19.9983	20.3799	20.6851	20.8297	20.7932	20.5249	20.0360	19.5575	19.6931	19.6931	(87)
Th 2	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	(88)
util rest of house	0.9992	0.9980	0.9947	0.9813	0.9383	0.8245	0.6556	0.7294	0.9292	0.9908	0.9983	0.9994	0.9994	(89)
MIT 2	19.3352	18.1929	18.5276	19.0069	19.4879	19.8541	20.0046	19.9735	19.6727	19.0570	18.4439	18.7591	18.7591	(90)
Living area fraction													0.0918	(91)
MIT	19.4073	18.3002	18.6282	19.0980	19.5699	19.9305	20.0804	20.0488	19.7510	19.1469	18.5462	18.8449	18.8449	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.4073	18.3002	18.6282	19.0980	19.5699	19.9305	20.0804	20.0488	19.7510	19.1469	18.5462	18.8449	18.8449	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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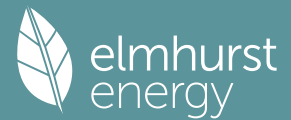


Utilisation	0.9990	0.9968	0.9920	0.9744	0.9248	0.8884	0.6443	0.7153	0.9146	0.9866	0.9972	0.9991 (94)
Useful gains	2210.3526	2724.7474	3194.0493	3763.0677	3987.8154	3518.7779	2667.2163	2661.2202	2971.7803	2608.5006	2232.0257	2082.1081 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	12836.7461	11386.2780	10305.4422	8665.3028	6687.0783	4529.3225	2957.3397	3100.4295	4801.6567	7262.3616	9725.9278	12443.8543 (97)
Space heating kWh	7906.0368	5820.5486	5290.8763	3529.6092	2008.2515	0.0000	0.0000	0.0000	0.0000	3462.4725	5395.6095	7709.1392 (98a)
Space heating requirement - total per year (kWh/year)												41122.5436
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	7906.0368	5820.5486	5290.8763	3529.6092	2008.2515	0.0000	0.0000	0.0000	0.0000	3462.4725	5395.6095	7709.1392 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												41122.5436
Space heating per m2												(98c) / (4) = 43.6624 (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)
Fraction of main heating from main system 2												0.5000 (203)
Fraction of total heating from main system 1												0.5000 (204)
Fraction of total heating from main system 2												0.5000 (205)
Efficiency of main space heating system 1 (in %)												323.9624 (206)
Efficiency of main space heating system 2 (in %)												323.9624 (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	7906.0368	5820.5486	5290.8763	3529.6092	2008.2515	0.0000	0.0000	0.0000	0.0000	3462.4725	5395.6095	7709.1392 (98)
Space heating efficiency (main heating system 1)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (210)
Space heating fuel (main heating system)	1220.2092	898.3372	816.5881	544.7561	309.9514	0.0000	0.0000	0.0000	0.0000	534.3943	832.7525	1189.8202 (211)
Space heating efficiency (main heating system 2)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (212)
Space heating fuel (main heating system 2)	1220.2092	898.3372	816.5881	544.7561	309.9514	0.0000	0.0000	0.0000	0.0000	534.3943	832.7525	1189.8202 (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)
Space heating fuel used, main system 2												6346.8090 (213)
Water heating												
Water heating requirement	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602 (64)
Efficiency of water heater	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557 (216)
Fuel for water heating, kWh/month	197.9915	174.8754	184.9497	160.3126	153.9053	137.0249	133.8952	140.0507	142.5412	160.9541	173.6442	195.5015 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fans	290.6249	262.4999	290.6249	281.2499	290.6249	281.2499	290.6249	290.6249	281.2499	290.6249	281.2499	290.6249 (231)
Lighting	145.8026	116.9683	105.3170	77.1597	59.6004	48.6940	54.3695	70.6715	91.7953	120.4404	136.0371	149.8549 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												6346.8090 (211)
Space heating fuel - main system 2												6346.8090 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												196.7557
Water heating fuel used												1955.6463 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV Centralised, DataSheet: in-use factor = 1.0000, SFP = 0.9400)												
mechanical ventilation fans (SFP = 0.9400)												3421.8737 (230a)
Total electricity for the above, kWh/year												3421.8737 (231)
Electricity for lighting (calculated in Appendix L)												1176.7108 (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												19247.8488 (238)

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 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	6346.8090	0.1542	978.7437 (261)
Space heating - main system 2	6346.8090	0.1542	978.7437 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1955.6463	0.1412	276.1480 (264)
Space and water heating			2233.6354 (265)
Pumps, fans and electric keep-hot	3421.8737	0.1387	474.6561 (267)
Energy for lighting	1176.7108	0.1443	169.8357 (268)
Total CO2, kg/year			2878.1272 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.0600 (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	6346.8090	1.5709	9970.2401 (275)
Space heating - main system 2	6346.8090	1.5709	9970.2401 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1955.6463	1.5221	2976.7714 (278)
Space and water heating			22917.2515 (279)
Pumps, fans and electric keep-hot	3421.8737	1.5128	5176.6105 (281)
Energy for lighting	1176.7108	1.5338	1804.8783 (282)
Total Primary energy kWh/year			29898.7403 (286)
Dwelling Primary energy Rate (DPER)			31.7500 (287)

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

 1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2983.8452 (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) = 0.0134 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2634 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2634 (21)

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

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Effective ac	0.3358	0.3293	0.3227	0.2897	0.2832	0.2502	0.2502	0.2437	0.2634	0.2832	0.2963	0.3095 (22b)
	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479 (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			2.1000	1.0000	2.1000		(26)
TER Semi-glazed door			10.7200	1.0000	10.7200		(26a)
TER Opening Type (Uw = 1.20)			86.7600	1.1450	99.3435		(27)
Roof Window			1.4400	1.5918	2.2921		(27a)
Roof Window			1.4400	1.5918	2.2921		(27a)
Roof Window			0.8500	1.5918	1.3530		(27a)
Basement Floor			209.5000	0.1300	27.2350		(28)
Ground Floor			103.8300	0.1300	13.4979		(28a)
Basement Wall	184.6500		184.6500	0.1800	33.2370		(29a)
External Wall	611.6400	99.5800	512.0600	0.1800	92.1708		(29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1100	34.7875		(30)
Balcony Flat Roof	11.8700		11.8700	0.1100	1.3057		(30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1100	9.2697		(30)
Total net area of external elements Aum(A, m2)			1525.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 329.6044		(33)

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

137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0500	2.5795
E3 Sill	45.6200	0.0500	2.2810
E4 Jamb	137.2600	0.0500	6.8630
R1 Head of roof window	3.0500	0.0800	0.2440
R2 Sill of roof window	3.0500	0.0600	0.1830
R3 Jamb of roof window	7.4000	0.0800	0.5920
E5 Ground floor (normal)	105.3000	0.1600	16.8480
E22 Basement floor	61.5500	0.0700	4.3085
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	92.5500	0.0400	3.7020
E13 Gable (insulation at rafter level)	24.1000	0.0800	1.9280
E14 Flat roof	13.8000	0.0800	1.1040
E16 Corner (normal)	109.4400	0.0900	9.8496
E17 Corner (inverted - internal area greater than external area)	70.4800	-0.0900	-6.3432
R6 Flat ceiling	37.2000	0.0600	2.2320

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

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 375.9758 (37)

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

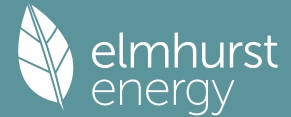
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	547.8648	545.7085	543.5949	533.6673	531.8099	523.1633	523.1633	521.5621	526.4938	531.8099	535.5674	539.4958 (38)
Average = Sum(39)m / 12 =	923.8406	921.6843	919.5707	909.6431	907.7857	899.1391	899.1391	897.5379	902.4696	907.7857	911.5432	915.4715 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9809	0.9786	0.9764	0.9658	0.9639	0.9547	0.9547	0.9530	0.9582	0.9639	0.9678	0.9720 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	90.7221	89.3587	87.3720	83.5708	80.7656	77.6373	75.8591	77.8308	79.9921	83.3510	87.2339	90.3745 (42a)
Hot water usage for baths	39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044 (42b)
Hot water usage for other uses	55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490 (42c)
Average daily hot water use (litres/day)	43.9748	38.6942	40.6542	34.7071	32.9298	28.8995	27.9793	29.5358	30.3490	34.7637	38.0862	43.3624 (43)
Daily hot water use	185.1078	181.1541	176.3398	169.0204	163.0761	156.6857	154.2307	159.0242	164.0795	170.7883	178.2204	184.6279 (44)
Energy content (annual)	293.1654	257.9610	271.0278	231.3805	219.5318	192.6633	186.5287	196.9052	202.3265	231.7581	253.9077	289.0826 (45)
Distribution loss (46)m = 0.15 x (45)m	43.9748	38.6942	40.6542	34.7071	32.9298	28.8995	27.9793	29.5358	30.3490	34.7637	38.0862	43.3624 (46)
Water storage loss:												500.0000 (47)
Store volume												2.9009 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.5665 (55)
Enter (49) or (54) in (55)												
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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)

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Total heat required for water heating calculated for each month												
	364.9886	322.8335	342.8509	300.8867	291.3549	262.1696	258.3518	268.7283	271.8327	303.5812	323.4139	360.9057 (62)
WWHRS	-41.4744	-36.6803	-38.4095	-31.8045	-29.6407	-25.3638	-23.7745	-25.2818	-26.2423	-30.9368	-35.0476	-40.7063 (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	323.5142	286.1532	304.4414	269.0822	261.7142	236.8058	234.5773	243.4465	245.5904	272.6444	288.3663	320.1994 (64)
	Total per year (kWh/year) = Sum(64)m =											3286.5354 (64)
12Total per year (kWh/year)												3287 (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												
	154.9360	137.6700	147.5752	132.5390	130.4528	119.6655	119.4793	122.9295	122.8785	134.5181	140.0293	153.5785 (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	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	514.9815	570.1581	514.9815	532.1476	514.9815	532.1476	514.9815	514.9815	532.1476	514.9815	532.1476	514.9815 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	878.3863	887.5012	864.5319	815.6331	753.9071	695.8934	657.1366	648.0217	670.9910	719.8898	781.6158	839.6295 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315 (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)	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524 (71)
Water heating gains (Table 5)	208.2473	204.8661	198.3538	184.0819	175.3398	166.2022	160.5904	165.2278	170.6647	180.8038	194.4851	206.4227 (72)
Total internal gains	1687.1097	1748.0200	1663.3619	1617.3572	1529.7231	1476.7377	1415.2032	1410.7257	1456.2979	1501.1698	1593.7432	1646.5284 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
North	41.7900	10.6334	0.6300	0.7000	0.7700	135.8051 (74)						
East	12.4200	19.6403	0.6300	0.7000	0.7700	74.5488 (76)						
South	11.0600	46.7521	0.6300	0.7000	0.7700	158.0257 (78)						
West	21.4900	19.6403	0.6300	0.7000	0.7700	128.9899 (80)						
North	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)						
East	0.8500	26.0000	0.6300	0.7000	1.0000	8.7715 (82)						
South	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)						
Solar gains	535.8608	996.4443	1568.5205	2259.3645	2798.7720	2891.0554	2740.8573	2324.8068	1807.4938	1158.2480	657.4906	448.2321 (83)
Total gains	2222.9706	2744.4643	3231.8824	3876.7217	4328.4950	4367.7931	4156.0606	3735.5325	3263.7917	2659.4178	2251.2338	2094.7604 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.0355	39.1268	39.2168	39.6448	39.7259	40.1079	40.1079	40.1795	39.9599	39.7259	39.5621	39.3924
alpha	3.6024	3.6085	3.6145	3.6430	3.6484	3.6739	3.6739	3.6786	3.6640	3.6484	3.6375	3.6262
util living area	0.9992	0.9982	0.9955	0.9854	0.9554	0.8792	0.7663	0.8237	0.9531	0.9929	0.9985	0.9994 (86)
MIT	18.5540	18.7575	19.1238	19.6630	20.1983	20.6427	20.8560	20.8036	20.4189	19.7341	19.0622	18.5328 (87)
Th 2	20.0993	20.1012	20.1031	20.1119	20.1136	20.1213	20.1213	20.1227	20.1183	20.1136	20.1102	20.1067 (88)
util rest of house	0.9990	0.9978	0.9944	0.9815	0.9412	0.8333	0.6690	0.7404	0.9319	0.9905	0.9981	0.9992 (89)
MIT 2	17.1583	17.4204	17.8911	18.5856	19.2624	19.8040	20.0289	19.9848	19.5465	18.6799	17.8169	17.1356 (90)
Living area fraction	17.2864	17.5432	18.0043	18.6845	19.3483	19.8810	20.1049	20.0600	19.6266	18.7767	17.9313	17.2639 (92)
MIT	17.2864	17.5432	18.0043	18.6845	19.3483	19.8810	20.1049	20.0600	19.6266	18.7767	17.9313	17.2639 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2864	17.5432	18.0043	18.6845	19.3483	19.8810	20.1049	20.0600	19.6266	18.7767	17.9313	17.2639 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9981	0.9959	0.9904	0.9721	0.9244	0.8176	0.6669	0.7331	0.9152	0.9847	0.9964	0.9985 (94)
Useful gains	2218.7957	2733.0793	3200.8687	3768.4753	4001.3939	3571.0572	2771.5354	2738.5787	2986.9722	2618.7307	2243.1967	2091.6404 (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	11997.4042	11653.0753	10579.0060	8900.4342	6943.0325	4748.3382	3151.3503	3284.9974	4987.6307	7422.7249	9873.1618	11959.6316 (97)

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Space heating kWh	7275.2847	5994.2373	5489.3342	3695.0104	2188.5791	0.0000	0.0000	0.0000	0.0000	3574.1717	5493.5749	7341.7854 (98a)
Space heating requirement - total per year (kWh/year)												41051.9777
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	7275.2847	5994.2373	5489.3342	3695.0104	2188.5791	0.0000	0.0000	0.0000	0.0000	3574.1717	5493.5749	7341.7854 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												41051.9777
Space heating per m2												(98c) / (4) = 43.5875 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	7275.2847	5994.2373	5489.3342	3695.0104	2188.5791	0.0000	0.0000	0.0000	0.0000	3574.1717	5493.5749	7341.7854 (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)	7882.2153	6494.2983	5947.2743	4003.2615	2371.1583	0.0000	0.0000	0.0000	0.0000	3872.3421	5951.8688	7954.2637 (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	323.5142	286.1532	304.4414	269.0822	261.7142	236.8058	234.5773	243.4465	245.5904	272.6444	288.3663	320.1994 (64)
Efficiency of water heater	88.3757	88.3460	88.2768	88.1253	87.7430	79.8000	79.8000	79.8000	79.8000	88.0958	88.3033	79.8000 (216)
Fuel for water heating, kWh/month	366.0671	323.9006	344.8712	305.3403	298.2735	296.7491	293.9565	305.0708	307.7574	309.4862	326.5634	362.2844 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	107.0030	85.8418	77.2910	56.6267	43.7401	35.7360	39.9012	51.8651	67.3676	88.3899	99.8362	109.9769 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-180.1601	-246.1742	-342.6027	-371.8677	-389.1667	-358.0727	-352.7793	-338.3557	-311.8784	-274.3366	-194.9148	-156.6136 (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)	-126.5892	-263.1298	-517.6861	-770.3325	-1012.2510	-1015.6884	-1004.5477	-854.0723	-630.1561	-374.8361	-168.4328	-100.4178 (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												44476.6822 (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												3840.3206 (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)												863.5754 (232)

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

PV generation												-10355.0624 (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												38911.5159 (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	44476.6822	0.2100	9340.1033 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3840.3206	0.2100	806.4673 (264)

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Space and water heating			10146.5706 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	863.5754	0.1443	124.6406 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3516.9225	0.1354	-476.0614
PV Unit electricity exported	-6838.1399	0.1262	-862.6446
Total			-1338.7060 (269)
Total CO2, kg/year			8944.4345 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5000 (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	44476.6822	1.1300	50258.6509 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3840.3206	1.1300	4339.5623 (278)
Space and water heating			54598.2132 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	863.5754	1.5338	1324.5808 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3516.9225	1.5003	-5276.5192
PV Unit electricity exported	-6838.1399	0.4631	-3166.5644
Total			-8443.0836 (283)
Total Primary energy kWh/year			47609.8112 (286)
Target Primary Energy Rate (TPER)			50.5500 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2983.8452 (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) = 0.0134 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1634 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1634 (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	0.2083	0.2043	0.2002	0.1797	0.1757	0.1552	0.1552	0.1512	0.1634	0.1757	0.1838	0.1920 (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)

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Effective ac 0.5217 0.5209 0.5200 0.5162 0.5154 0.5120 0.5120 0.5114 0.5134 0.5154 0.5169 0.5184 (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
Solid Door			2.1000	1.8000	3.7800		(26)
Half-glazed Door			10.7200	1.4000	15.0080		(26a)
Windows (Uw = 1.20)			36.9800	1.1450	42.3435		(27)
French Doors (Uw = 1.40)			22.9900	1.3258	30.4792		(27)
Bi-folding Doors (Uw = 1.40)			26.7900	1.3258	35.5170		(27)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			0.8500	1.1450	0.9733		(27a)
Basement Floor			209.5000	0.1200	25.1400	110.0000	23045.0000 (28)
Ground Floor			103.8300	0.1400	14.5362	75.0000	7787.2500 (28a)
Basement Wall	184.6500		184.6500	0.1700	31.3905	9.0000	1661.8500 (29a)
External Wall	611.6400	99.5800	512.0600	0.1200	61.4472	60.0000	30723.6000 (29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1300	41.1125	9.0000	2846.2500 (30)
Balcony Flat Roof	11.8700		11.8700	0.1300	1.5431	9.0000	106.8300 (30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1200	10.1124	9.0000	758.4300 (30)
Total net area of external elements Aum(A, m2)			1525.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 316.6806		(33)
Internal Wall - Masonry			615.1800			75.0000	46138.5000 (32c)
Internal Wall - Timber			642.0600			9.0000	5778.5400 (32c)
Internal Floor - 2F/1F			209.5000			18.0000	3771.0000 (32d)
Internal Floor - 1F/GF			190.9500			18.0000	3437.1000 (32d)
Internal Ceiling - GF/1F			209.5000			9.0000	1885.5000 (32e)
Internal Ceiling - 1F/2F			209.5000			9.0000	1885.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 129825.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0240	1.2382
E3 Sill	45.6200	0.0270	1.2317
E4 Jamb	137.2600	0.0410	5.6277
R1 Head of roof window	3.0500	0.2400	0.7320
R2 Sill of roof window	3.0500	0.2400	0.7320
R3 Jamb of roof window	7.4000	0.2400	1.7760
E5 Ground floor (normal)	105.3000	0.0560	5.8968
E22 Basement floor	61.5500	0.2200	13.5410
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.1000	0.8500
E11 Eaves (insulation at rafter level)	92.5500	0.0070	0.6479
E13 Gable (insulation at rafter level)	24.1000	0.0530	1.2773
E14 Flat roof	13.8000	0.1600	2.2080
E16 Corner (normal)	109.4400	0.0410	4.4870
E17 Corner (inverted - internal area greater than external area)	70.4800	-0.0570	-4.0174
R6 Flat ceiling	37.2000	0.1200	4.4640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 40.6922 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 357.3728 (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	513.7049	512.8751	512.0617	508.2411	507.5263	504.1987	504.1987	503.5825	505.4805	507.5263	508.9724	510.4842 (38)
Average = Sum(39)m / 12 =	871.0777	870.2479	869.4345	865.6139	864.8991	861.5715	861.5715	860.9553	862.8533	864.8991	866.3452	867.8570 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9249	0.9240	0.9231	0.9191	0.9183	0.9148	0.9148	0.9141	0.9161	0.9183	0.9199	0.9215 (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	3.9663 (42)												
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044	(42b)
Hot water usage for other uses	55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490	(42c)
Average daily hot water use (litres/day)													86.5122 (43)
Daily hot water use	94.3857	91.7954	88.9678	85.4496	82.3105	79.0484	78.3716	81.1934	84.0874	87.4373	90.9866	94.2533	(44)
Energy content (annual)	149.4838	130.7154	136.7402	116.9762	110.8057	97.1992	94.7836	100.5344	103.6882	118.6515	129.6270	147.5780	(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)

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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	127.0612	111.1081	116.2292	99.4298	94.1849	82.6193	80.5661	85.4542	88.1350	100.8538	110.1830	125.4413 (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	127.0612	111.1081	116.2292	99.4298	94.1849	82.6193	80.5661	85.4542	88.1350	100.8538	110.1830	125.4413 (64)
										Total per year (kWh/year) = Sum(64)m =		1221.2658 (64)
												1221 (64)
12Total per year (kWh/year)												
Electric shower(s)	72.6533	64.7347	70.6878	67.4565	68.7223	65.5544	67.7395	68.7223	67.4565	70.6878	69.3586	72.6533 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		826.4269 (64a)
Heat gains from water heating, kWh/month												
	49.9286	43.9607	46.7292	41.7216	40.7268	37.0434	37.0764	38.5441	38.8979	42.8854	44.8854	49.5236 (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	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154	198.3154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	514.9815	570.1581	514.9815	532.1476	514.9815	532.1476	514.9815	514.9815	532.1476	514.9815	532.1476	514.9815 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	878.3863	887.5012	864.5319	815.6331	753.9071	695.8934	657.1366	648.0217	670.9910	719.8898	781.6158	839.6295 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315	42.8315 (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)	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524 (71)
Water heating gains (Table 5)	67.1084	65.4177	62.8081	57.9466	54.7403	51.4492	49.8339	51.8066	54.0248	57.6417	62.3408	66.5640 (72)
Total internal gains	1542.9708	1605.5716	1524.8162	1488.2219	1406.1236	1361.9848	1304.4467	1297.3045	1339.6580	1375.0077	1458.5988	1503.6697 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.4000	10.6334	0.6300	0.7000	0.7700	17.5484 (74)
East	12.4200	19.6403	0.6300	0.7000	0.7700	74.5488 (76)
South	11.0600	46.7521	0.6300	0.7000	0.7700	158.0257 (78)
West	8.1000	19.6403	0.6300	0.7000	0.7700	48.6188 (80)
North	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
East	0.8500	26.0000	0.6300	0.7000	1.0000	8.7715 (82)
South	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
North	9.6000	10.6334	0.6300	0.7000	0.7700	31.1971 (74)
West	13.3900	19.6403	0.6300	0.7000	0.7700	80.3711 (80)
North	26.7900	10.6334	0.6300	0.7000	0.7700	87.0595 (74)

Solar gains	535.8608	996.4443	1568.5205	2259.3645	2798.7720	2891.0554	2740.8573	2324.8068	1807.4938	1158.2480	657.4906	448.2321 (83)
Total gains	2078.8316	2602.0159	3093.3367	3747.5864	4204.8955	4253.0402	4045.3040	3622.1113	3147.1519	2533.2556	2116.0895	1951.9018 (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	41.4000	41.4395	41.4782	41.6613	41.6957	41.8568	41.8568	41.8867	41.7946	41.6957	41.6261	41.5536
alpha	3.7600	3.7626	3.7652	3.7774	3.7797	3.7905	3.7905	3.7924	3.7863	3.7797	3.7751	3.7702
util living area	0.9994	0.9986	0.9962	0.9867	0.9569	0.8799	0.7648	0.8251	0.9557	0.9940	0.9988	0.9996 (86)
MIT	18.6516	18.8500	19.2051	19.7216	20.2415	20.6653	20.8683	20.8164	20.4437	19.7778	19.1273	18.6191 (87)
Th 2	20.1464	20.1472	20.1479	20.1513	20.1520	20.1550	20.1550	20.1555	20.1538	20.1520	20.1507	20.1493 (88)
util rest of house	0.9993	0.9982	0.9953	0.9831	0.9434	0.8352	0.6701	0.7442	0.9360	0.9920	0.9985	0.9995 (89)
MIT 2	17.9380	18.1368	18.4921	19.0090	19.5211	19.9219	20.0885	20.0539	19.7237	19.0672	18.4166	17.9075 (90)
Living area fraction	fLA = Living area / (4) =											0.0918 (91)
MIT	18.0035	18.2023	18.5576	19.0744	19.5873	19.9902	20.1601	20.1240	19.7898	19.1324	18.4819	17.9729 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0035	18.2023	18.5576	19.0744	19.5873	19.9902	20.1601	20.1240	19.7898	19.1324	18.4819	17.9729 (93)

8. Space heating requirement

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9972	0.9929	0.9768	0.9316	0.8245	0.6708	0.7406	0.9243	0.9884	0.9976	0.9991	(94)
Useful gains	2076.4288	2594.6720	3071.2547	3660.7534	3917.3893	3506.8117	2713.6001	2682.4679	2909.0221	2503.8424	2111.1034	1950.1403	(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	11936.8412	11576.3349	10483.2814	8807.1222	6821.6928	4644.0027	3067.2726	3206.1569	4909.4551	7379.7068	9860.6360	11952.8971	(97)
Space heating kWh	7336.1468	6035.6775	5514.5479	3705.3855	2160.8018	0.0000	0.0000	0.0000	0.0000	3627.6431	5579.6634	7442.0510	(98a)
Space heating requirement - total per year (kWh/year)												41401.9172	
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	7336.1468	6035.6775	5514.5479	3705.3855	2160.8018	0.0000	0.0000	0.0000	0.0000	3627.6431	5579.6634	7442.0510	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												41401.9172	
Space heating per m2												(98c) / (4) =	43.9590 (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	8098.7724	6375.6293	6543.2604	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5378	0.6247	0.5594	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	4355.6243	3982.5731	3660.2620	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4606.4121	4377.7729	3902.4452	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	180.5672	294.0287	180.1843	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	45.1418	73.5072	45.0461	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												163.6950	(107)
Energy for space heating												43.9590	(99)
Energy for space cooling												0.1738	(108)
Total												44.1328	(109)
Fabric Energy Efficiency (DFEE)												44.1	(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)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2983.8452 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0134 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2634 (18)
Number of sides sheltered	0 (19)

Full SAP Calculation Printout



Shelter factor

Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 1.0000 \quad (20)$$

$$(21) = (18) \times (20) = 0.2634 \quad (21)$$

	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
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
Adj infilt rate	0.3358	0.3293	0.3227	0.2897	0.2832	0.2502	0.2502	0.2437	0.2634	0.2832	0.2963	0.3095
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479

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			2.1000	1.0000	2.1000		(26)
TER Semi-glazed door			10.7200	1.0000	10.7200		(26a)
TER Opening Type (Uw = 1.20)			86.7600	1.1450	99.3435		(27)
Roof Window			1.4400	1.5918	2.2921		(27a)
Roof Window			1.4400	1.5918	2.2921		(27a)
Roof Window			0.8500	1.5918	1.3530		(27a)
Basement Floor			209.5000	0.1300	27.2350		(28)
Ground Floor			103.8300	0.1300	13.4979		(28a)
Basement Wall	184.6500		184.6500	0.1800	33.2370		(29a)
External Wall	611.6400	99.5800	512.0600	0.1800	92.1708		(29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1100	34.7875		(30)
Balcony Flat Roof	11.8700		11.8700	0.1100	1.3057		(30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1100	9.2697		(30)
Total net area of external elements Aum(A, m2)			1525.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 329.6044		(33)

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

137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0500	2.5795
E3 Sill	45.6200	0.0500	2.2810
E4 Jamb	137.2600	0.0500	6.8630
R1 Head of roof window	3.0500	0.0800	0.2440
R2 Sill of roof window	3.0500	0.0600	0.1830
R3 Jamb of roof window	7.4000	0.0800	0.5920
E5 Ground floor (normal)	105.3000	0.1600	16.8480
E22 Basement floor	61.5500	0.0700	4.3085
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	92.5500	0.0400	3.7020
E13 Gable (insulation at rafter level)	24.1000	0.0800	1.9280
E14 Flat roof	13.8000	0.0800	1.1040
E16 Corner (normal)	109.4400	0.0900	9.8496
E17 Corner (inverted - internal area greater than external area)	70.4800	-0.0900	-6.3432
R6 Flat ceiling	37.2000	0.0600	2.2320

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

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 375.9758 (37)

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

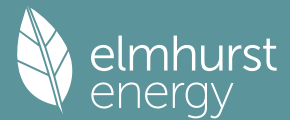
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	547.8648	545.7085	543.5949	533.6673	531.8099	523.1633	523.1633	521.5621	526.4938	531.8099	535.5674	539.4958
Heat transfer coeff	923.8406	921.6843	919.5707	909.6431	907.7857	899.1391	899.1391	897.5379	902.4696	907.7857	911.5432	915.4715
Average = Sum(39)m / 12 =												909.6342

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9809	0.9786	0.9764	0.9658	0.9639	0.9547	0.9547	0.9530	0.9582	0.9639	0.9678	0.9720
HLP (average)												0.9658
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.9663 (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
Hot water usage for baths	39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044
Hot water usage for other uses	55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490
Average daily hot water use (litres/day)												86.5122
Daily hot water use	94.3857	91.7954	88.9678	85.4496	82.3105	79.0484	78.3716	81.1934	84.0874	87.4373	90.9866	94.2533
Energy conte	149.4838	130.7154	136.7402	116.9762	110.8057	97.1992	94.7836	100.5344	103.6882	118.6515	129.6270	147.5780
Energy content (annual)												1436.7833
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

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9970	0.9926	0.9768	0.9334	0.8305	0.6809	0.7487	0.9261	0.9881	0.9975	0.9990	(94)
Useful gains	2076.1381	2594.0895	3070.3489	3660.8144	3925.0137	3532.2648	2754.5209	2711.7356	2914.6247	2503.1910	2110.7159	1949.9302	(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	12517.3857	12124.1604	10963.5714	9158.3905	7081.3121	4795.6921	3163.6470	3303.3749	5075.9654	7663.0158	10269.4026	12480.5608	(97)
Space heating kWh	7768.2882	6404.2076	5872.5575	3958.2548	2348.2860	0.0000	0.0000	0.0000	0.0000	3838.9097	5874.2544	7834.7891	(98a)
Space heating requirement - total per year (kWh/year)												43899.5473	
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	7768.2882	6404.2076	5872.5575	3958.2548	2348.2860	0.0000	0.0000	0.0000	0.0000	3838.9097	5874.2544	7834.7891	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												43899.5473	
Space heating per m2											(98c) / (4) =	46.6109	(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	8451.9073	6653.6292	6821.2877	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5167	0.6016	0.5382	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	4366.9742	4003.1530	3671.4621	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4606.4121	4377.7729	3902.4452	0.0000	0.0000	0.0000	0.0000	(103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	172.3952	278.7172	171.8514	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	43.0988	69.6793	42.9628	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling requirement												155.7410	(107)	
Energy for space heating												46.6109	(99)	
Energy for space cooling												0.1654	(108)	
Total												46.7763	(109)	
Fabric Energy Efficiency (TFEE)												46.8	(109)	

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

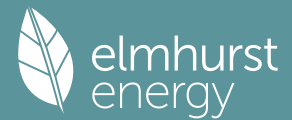
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2983.8452 (5)

2. Ventilation rate

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

Full SAP Calculation Printout



Shelter factor												(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.1500 (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	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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
Solid Door			2.1000	1.8000	3.7800		(26)
Half-glazed Door			10.7200	1.4000	15.0080		(26a)
Windows (Uw = 1.20)			36.9800	1.1450	42.3435		(27)
French Doors (Uw = 1.40)			22.9900	1.3258	30.4792		(27)
Bi-folding Doors (Uw = 1.40)			26.7900	1.3258	35.5170		(27)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			0.8500	1.1450	0.9733		(27a)
Basement Floor			209.5000	0.1200	25.1400	110.0000	23045.0000 (28)
Ground Floor			103.8300	0.1400	14.5362	75.0000	7787.2500 (28a)
Basement Wall	184.6500		184.6500	0.1700	31.3905	9.0000	1661.8500 (29a)
External Wall	611.6400	99.5800	512.0600	0.1200	61.4472	60.0000	30723.6000 (29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1300	41.1125	9.0000	2846.2500 (30)
Balcony Flat Roof	11.8700		11.8700	0.1300	1.5431	9.0000	106.8300 (30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1200	10.1124	9.0000	758.4300 (30)
Total net area of external elements Aum(A, m2)			1525.7400				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	316.6806	(33)
Internal Wall - Masonry			615.1800			75.0000	46138.5000 (32c)
Internal Wall - Timber			642.0600			9.0000	5778.5400 (32c)
Internal Floor - 2F/1F			209.5000			18.0000	3771.0000 (32d)
Internal Floor - 1F/GF			190.9500			18.0000	3437.1000 (32d)
Internal Ceiling - GF/1F			209.5000			9.0000	1885.5000 (32e)
Internal Ceiling - 1F/2F			209.5000			9.0000	1885.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 129825.3500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0240	1.2382
E3 Sill	45.6200	0.0270	1.2317
E4 Jamb	137.2600	0.0410	5.6277
R1 Head of roof window	3.0500	0.2400	0.7320
R2 Sill of roof window	3.0500	0.2400	0.7320
R3 Jamb of roof window	7.4000	0.2400	1.7760
E5 Ground floor (normal)	105.3000	0.0560	5.8968
E22 Basement floor	61.5500	0.2200	13.5410
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.1000	0.8500
E11 Eaves (insulation at rafter level)	92.5500	0.0070	0.6479
E13 Gable (insulation at rafter level)	24.1000	0.0530	1.2773
E14 Flat roof	13.8000	0.1600	2.2080
E16 Corner (normal)	109.4400	0.0410	4.4870
E17 Corner (inverted - internal area greater than external area)	70.4800	-0.0570	-4.0174
R6 Flat ceiling	37.2000	0.1200	4.4640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 40.6922 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 357.3728 (37)

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

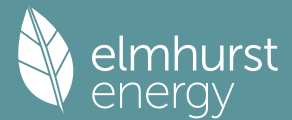
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	(38)
Heat transfer coeff	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	(39)
Average = Sum(39)m / 12 =													849.7073

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	(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													3.9663 (42)
Hot water usage for mixer showers													
	124.7429	122.8682	120.1365	114.9099	111.0527	106.7513	104.3063	107.0174	109.9892	114.6076	119.9466	124.2649	(42a)
Hot water usage for baths													
	39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044	(42b)

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Hot water usage for other uses													
55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490	(42c)	
Average daily hot water use (litres/day)													
201.5210												(43)	
Daily hot water use													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
219.1285	214.6636	209.1043	200.3595	193.3632	185.7997	182.6779	188.2108	194.0766	202.0449	210.9331	218.5183	(44)	
347.0461	305.6781	321.3856	274.2821	260.3041	228.4624	220.9331	233.0442	239.3159	274.1730	300.5129	342.1468	(45)	
Energy content (annual)											Total = Sum(45)m =	3347.2843	
Distribution loss (46)m = 0.15 x (45)m													
52.0569	45.8517	48.2078	41.1423	39.0456	34.2694	33.1400	34.9566	35.8974	41.1260	45.0769	51.3220	(46)	
Water storage loss:													
Store volume												500.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6210	(55)
Total storage loss													
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(56)	
If cylinder contains dedicated solar storage													
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(57)	
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	23.2624	22.5120	22.5120	23.2624	(59)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	(62)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
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)	
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)	
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													
389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	(64)	
Total per year (kWh/year) = Sum(64)m =											3847.8453	(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													
149.4035	132.3573	140.8714	124.1124	120.5618	108.8773	107.4710	111.4979	112.4861	125.1733	132.8341	147.7745	(65)	

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

Metabolic gains (Table 5), Watts												
(66)m	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
166.5756	147.9510	120.3218	91.0913	68.0918	57.4860	62.1157	80.7403	108.3694	137.5999	160.5994	171.2052	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
1311.0243	1324.6286	1290.3461	1217.3628	1125.2345	1038.6468	980.8010	967.1966	1001.4791	1074.4624	1166.5908	1253.1784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	(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)												
-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	(71)
Water heating gains (Table 5)												
200.8112	196.9603	189.3433	172.3783	162.0455	151.2185	144.4502	149.8628	156.2307	168.2436	184.4919	198.6217	(72)
Total internal gains												
1820.5014	1811.6302	1742.1016	1622.9228	1497.4621	1389.4417	1329.4572	1339.8901	1408.1696	1522.3963	1653.7724	1765.0957	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.4000	10.6334	0.6300	0.7000	0.7700	17.5484 (74)
East	12.4200	19.6403	0.6300	0.7000	0.7700	74.5488 (76)
South	11.0600	46.7521	0.6300	0.7000	0.7700	158.0257 (78)
West	8.1000	19.6403	0.6300	0.7000	0.7700	48.6188 (80)
North	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
East	0.8500	26.0000	0.6300	0.7000	1.0000	8.7715 (82)
South	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
North	9.6000	10.6334	0.6300	0.7000	0.7700	31.1971 (74)
West	13.3900	19.6403	0.6300	0.7000	0.7700	80.3711 (80)
North	26.7900	10.6334	0.6300	0.7000	0.7700	87.0595 (74)

Solar gains	535.8608	996.4443	1568.5205	2259.3645	2798.7720	2891.0554	2740.8573	2324.8068	1807.4938	1158.2480	657.4906	448.2321	(83)
Total gains	2356.3622	2808.0745	3310.6221	3882.2873	4296.2341	4280.4971	4070.3145	3664.6969	3215.6635	2680.6442	2311.2630	2213.3277	(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	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412		
alpha	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294		
util living area													

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(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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													6292.3387	(211)
Space heating fuel - main system 2													6292.3387	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													196.7557	
Water heating fuel used													1955.6463	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(MEVCentralised, DataSheet: in-use factor = 1.0000, SFP = 0.9400)														
mechanical ventilation fans (SFP = 0.9400)													3421.8737	(230a)
Total electricity for the above, kWh/year													3421.8737	(231)
Electricity for lighting (calculated in Appendix L)													1176.7108	(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													19138.9082	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6292.3387	16.4900	1037.6067	(240)
Space heating - main system 2	6292.3387	16.4900	1037.6067	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.6463	16.4900	322.4861	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	3421.8737	16.4900	564.2670	(249)
Energy for lighting	1176.7108	16.4900	194.0396	(250)
Additional standing charges			0.0000	(251)
Total energy cost			3156.0060	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1513	(257)
SAP value		81.3370	
SAP rating (Section 12)		81	(258)
SAP band		B	

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

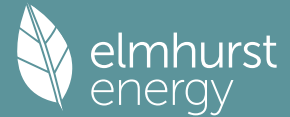
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6292.3387	0.1542	970.1407	(261)
Space heating - main system 2	6292.3387	0.1542	970.1407	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.6463	0.1412	276.1480	(264)
Space and water heating			2216.4294	(265)
Pumps, fans and electric keep-hot	3421.8737	0.1387	474.6561	(267)
Energy for lighting	1176.7108	0.1443	169.8357	(268)
Total CO2, kg/year			2860.9212	(272)
CO2 emissions per m2			3.0400	(273)
EI value			96.1152	
EI rating			96	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	209.5000 (1a)	x	3.0000 (2a)	=	628.5000 (1a)	-
Ground floor	313.3300 (1b)	x	3.9400 (2b)	=	1234.5202 (1b)	-

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First floor 209.5000 (1c) x 2.8000 (2c) = 586.6000 (1c) -
 Second floor 209.5000 (1d) x 2.5500 (2d) = 534.2250 (1d) -
 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 941.8300 (4)
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2983.8452 (5)

2. Ventilation rate

m3 per hour

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 3.0000 (17)
 Infiltration rate 0.1500 (18)
 Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.3000	3.8000	3.8000	3.3000	3.4000	3.5000	3.5000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0500	1.0750	0.9500	0.9500	0.8250	0.8500	0.8750	0.8750	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.1650	0.1575	0.1612	0.1425	0.1425	0.1237	0.1275	0.1313	0.1313	0.1388	0.1425	0.1500 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

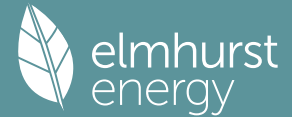
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1000	1.8000	3.7800		(26)
Half-glazed Door			10.7200	1.4000	15.0080		(26a)
Windows (Uw = 1.20)			36.9800	1.1450	42.3435		(27)
French Doors (Uw = 1.40)			22.9900	1.3258	30.4792		(27)
Bi-folding Doors (Uw = 1.40)			26.7900	1.3258	35.5170		(27)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			0.8500	1.1450	0.9733		(27a)
Basement Floor			209.5000	0.1200	25.1400	110.0000	23045.0000 (28)
Ground Floor			103.8300	0.1400	14.5362	75.0000	7787.2500 (28a)
Basement Wall	184.6500		184.6500	0.1700	31.3905	9.0000	1661.8500 (29a)
External Wall	611.6400	99.5800	512.0600	0.1200	61.4472	60.0000	30723.6000 (29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1300	41.1125	9.0000	2846.2500 (30)
Balcony Flat Roof	11.8700		11.8700	0.1300	1.5431	9.0000	106.8300 (30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1200	10.1124	9.0000	758.4300 (30)
Total net area of external elements Aum(A, m2)			1525.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 316.6806		(33)
Internal Wall - Masonry			615.1800			75.0000	46138.5000 (32c)
Internal Wall - Timber			642.0600			9.0000	5778.5400 (32c)
Internal Floor - 2F/1F			209.5000			18.0000	3771.0000 (32d)
Internal Floor - 1F/GF			190.9500			18.0000	3437.1000 (32d)
Internal Ceiling - GF/1F			209.5000			9.0000	1885.5000 (32e)
Internal Ceiling - 1F/2F			209.5000			9.0000	1885.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 129825.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0240	1.2382
E3 Sill	45.6200	0.0270	1.2317
E4 Jamb	137.2600	0.0410	5.6277
R1 Head of roof window	3.0500	0.2400	0.7320
R2 Sill of roof window	3.0500	0.2400	0.7320
R3 Jamb of roof window	7.4000	0.2400	1.7760
E5 Ground floor (normal)	105.3000	0.0560	5.8968
E22 Basement floor	61.5500	0.2200	13.5410
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.1000	0.8500
E11 Eaves (insulation at rafter level)	92.5500	0.0070	0.6479
E13 Gable (insulation at rafter level)	24.1000	0.0530	1.2773
E14 Flat roof	13.8000	0.1600	2.2080

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E16 Corner (normal)													109.4400	0.0410	4.4870
E17 Corner (inverted - internal area greater than external area)													70.4800	-0.0570	-4.0174
R6 Flat ceiling													37.2000	0.1200	4.4640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)															40.6922 (36)
Point Thermal bridges															0.0000
Total fabric heat loss															(36a) = 357.3728 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345 492.3345
 Heat transfer coeff 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073 849.7073
 Average = Sum(39)m / 12 = 849.7073 (39)

4. Water heating energy requirements (kWh/year)

Assumed occupancy																3.9663 (42)
Hot water usage for mixer showers																
Hot water usage for baths																
Hot water usage for other uses																
Average daily hot water use (litres/day)																201.5210 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy cont	219.1285	214.6636	209.1043	200.3595	193.3632	185.7997	182.6779	188.2108	194.0766	202.0449	210.9331	218.5183	(44)
Energy content (annual)	347.0461	305.6781	321.3856	274.2821	260.3041	228.4624	220.9331	233.0442	239.3159	274.1730	300.5129	342.1468	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	52.0569	45.8517	48.2078	41.1423	39.0456	34.2694	33.1400	34.9566	35.8974	41.1260	45.0769	51.3220	(46)

Store volume 500.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.1500 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 0.6210 (55)

Total heat required for water heating calculated for each month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Primary loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(56)
Combi loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(57)
Total heat required for water heating calculated for each month	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)
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	(61)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Electric shower(s)	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	(62)
Total per year (kWh/year) = Sum(64)m =													3847.8453 (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	149.4035	132.3573	140.8714	124.1124	120.5618	108.8773	107.4710	111.4979	112.4861	125.1733	132.8341	147.7745	(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	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	166.5756	147.9510	120.3218	91.0913	68.0918	57.4860	62.1157	80.7403	108.3694	137.5999	160.5994	171.2052	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1311.0243	1324.6286	1290.3461	1217.3628	1125.2345	1038.6468	980.8010	967.1966	1001.4791	1074.4624	1166.5908	1253.1784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	(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)	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	(71)
Water heating gains (Table 5)	200.8112	196.9603	189.3433	172.3783	162.0455	151.2185	144.4502	149.8628	156.2307	168.2436	184.4919	198.6217	(72)
Total internal gains	1820.5014	1811.6302	1742.1016	1622.9228	1497.4621	1389.4417	1329.4572	1339.8901	1408.1696	1522.3963	1653.7724	1765.0957	(73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.4000	12.0101	0.6300	0.7000	0.7700	19.8205 (74)
East	12.4200	22.3657	0.6300	0.7000	0.7700	84.8938 (76)
South	11.0600	51.2899	0.6300	0.7000	0.7700	173.3640 (78)
West	8.1000	22.3657	0.6300	0.7000	0.7700	55.3655 (80)
North	1.4400	30.0000	0.6300	0.7000	1.0000	17.1461 (82)
East	0.8500	30.0000	0.6300	0.7000	1.0000	10.1209 (82)
South	1.4400	30.0000	0.6300	0.7000	1.0000	17.1461 (82)
North	9.6000	12.0101	0.6300	0.7000	0.7700	35.2364 (74)
West	13.3900	22.3657	0.6300	0.7000	0.7700	91.5240 (80)
North	26.7900	12.0101	0.6300	0.7000	0.7700	98.3315 (74)

Solar gains	602.9488	1029.4582	1577.4198	2345.9196	2831.7547	3115.1587	2935.3179	2531.6552	1972.2132	1256.7626	758.4600	499.1265 (83)
Total gains	2423.4502	2841.0884	3319.5214	3968.8424	4329.2168	4504.6004	4264.7751	3871.5452	3380.3828	2779.1589	2412.2324	2264.2222 (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	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412
alpha	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294
util living area	0.9989	0.9979	0.9944	0.9798	0.9363	0.7928	0.6054	0.6646	0.9225	0.9893	0.9979	0.9992 (86)
Living	19.3060	19.4253	19.7091	20.1069	20.4808	20.7869	20.8878	20.8745	20.6258	20.1503	19.6545	19.2714
Non living	18.1212	18.2742	18.6378	19.1450	19.6125	19.9618	20.0490	20.0417	19.7931	19.2028	18.5683	18.0768
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0
16 / 9	27	0	0	0	0	0	0	0	0	0	0	20
MIT	20.1644	19.4253	19.7091	20.1069	20.4808	20.7869	20.8878	20.8745	20.6258	20.1503	19.6545	19.7550 (87)
Th 2	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656 (88)
util rest of house	0.9987	0.9974	0.9931	0.9743	0.9156	0.7201	0.4743	0.5340	0.8874	0.9855	0.9973	0.9990 (89)
MIT 2	19.3797	18.2742	18.6378	19.1450	19.6125	19.9618	20.0490	20.0417	19.7931	19.2028	18.5683	18.8296 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.4518	18.3799	18.7362	19.2334	19.6922	20.0376	20.1261	20.1182	19.8696	19.2898	18.6680	18.9146 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4518	18.3799	18.7362	19.2334	19.6922	20.0376	20.1261	20.1182	19.8696	19.2898	18.6680	18.9146 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9985	0.9960	0.9898	0.9657	0.9005	0.7070	0.4675	0.5256	0.8708	0.9796	0.9958	0.9987 (94)
Useful gains	2419.7442	2829.6763	3285.5983	3832.7596	3898.4605	3184.8900	1993.6180	2034.9361	2943.6026	2722.5129	2402.1123	2261.1982 (95)
Ext temp.	4.8000	5.3000	7.1000	9.7000	12.6000	15.7000	17.7000	17.6000	14.9000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	12449.7168	11114.1113	9887.3516	8100.5677	6026.3243	3685.6614	2061.4601	2139.7251	4222.7110	6704.0446	9319.6090	12078.2582 (97)
Space heating kWh	7462.2996	5567.1403	4911.7044	3072.8218	1583.1306	0.0000	0.0000	0.0000	0.0000	2962.2596	4980.5976	7303.8927 (98a)
Space heating requirement - total per year (kWh/year)												37843.8467
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	7462.2996	5567.1403	4911.7044	3072.8218	1583.1306	0.0000	0.0000	0.0000	0.0000	2962.2596	4980.5976	7303.8927 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												37843.8467
Space heating per m2										(98c) / (4) =		40.1812 (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)
Fraction of main heating from main system 2												0.5000 (203)
Fraction of total heating from main system 1												0.5000 (204)
Fraction of total heating from main system 2												0.5000 (205)
Efficiency of main space heating system 1 (in %)												323.9624 (206)
Efficiency of main space heating system 2 (in %)												323.9624 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	7462.2996	5567.1403	4911.7044	3072.8218	1583.1306	0.0000	0.0000	0.0000	0.0000	2962.2596	4980.5976	7303.8927 (98)
Space heating efficiency (main heating system 1)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (210)
Space heating fuel (main heating system)	1151.7233	859.2264	758.0672	474.2560	244.3387	0.0000	0.0000	0.0000	0.0000	457.1920	768.7001	1127.2749 (211)
Space heating efficiency (main heating system 2)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (212)
Space heating fuel (main heating system 2)	1151.7233	859.2264	758.0672	474.2560	244.3387	0.0000	0.0000	0.0000	0.0000	457.1920	768.7001	1127.2749 (213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2														5840.7785 (213)
Water heating														
Water heating requirement	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602		(64)
Efficiency of water heater (217)m	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557		(216)
Fuel for water heating, kWh/month	197.9915	174.8754	184.9497	160.3126	153.9053	137.0249	133.8952	140.0507	142.5412	160.9541	173.6442	195.5015		(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(221)
Pumps and Fa	290.6249	262.4999	290.6249	281.2499	290.6249	281.2499	290.6249	290.6249	281.2499	290.6249	281.2499	290.6249		(231)
Lighting	145.8026	116.9683	105.3170	77.1597	59.6004	48.6940	54.3695	70.6715	91.7953	120.4404	136.0371	149.8549		(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(235d)
Annual totals kWh/year														
Space heating fuel - main system 1														5840.7785 (211)
Space heating fuel - main system 2														5840.7785 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														196.7557
Water heating fuel used														1955.6463 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans:														
(MEVCentralised, DataSheet: in-use factor = 1.0000, SFP = 0.9400)														
mechanical ventilation fans (SFP = 0.9400)														3421.8737 (230a)
Total electricity for the above, kWh/year														3421.8737 (231)
Electricity for lighting (calculated in Appendix L)														1176.7108 (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														18235.7877 (238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5840.7785	18.3900	1074.1192 (240)
Space heating - main system 2	5840.7785	18.3900	1074.1192 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1955.6463	18.3900	359.6433 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	3421.8737	18.3900	629.2826 (249)
Energy for lighting	1176.7108	18.3900	216.3971 (250)
Additional standing charges			0.0000 (251)
Total energy cost			3353.5614 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5840.7785	0.1546	903.2603 (261)
Space heating - main system 2	5840.7785	0.1546	903.2603 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1955.6463	0.1412	276.1480 (264)
Space and water heating			2082.6687 (265)
Pumps, fans and electric keep-hot	3421.8737	0.1387	474.6561 (267)
Energy for lighting	1176.7108	0.1443	169.8357 (268)
Total CO2, kg/year			2727.1605 (272)

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

Energy Primary energy factor Primary energy

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	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	5840.7785	1.5725	9184.8013 (275)
Space heating - main system 2	5840.7785	1.5725	9184.8013 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1955.6463	1.5221	2976.7714 (278)
Space and water heating			21346.3741 (279)
Pumps, fans and electric keep-hot	3421.8737	1.5128	5176.6105 (281)
Energy for lighting	1176.7108	1.5338	1804.8783 (282)
Total Primary energy kWh/year			28327.8629 (286)

SAP 10 EPC IMPROVEMENTS

As Designed

Current energy efficiency rating: B 81
 Current environmental impact rating: A 96

N Solar water heating SAP increase too small
 U Solar photovoltaic panels Recommended
 V2 Wind turbine Recommended

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 1.2	-£ 242	-175 kg (6.4%)
V2 Wind turbine	+ 2.4	-£ 460	-347 kg (13.6%)

Measures omitted - SAP change or cost saving too small:
 N Solar water heating + 0.3 -£ 59 -39 kg (1.4%)

Recommended measures	Typical annual savings		Energy Environmental efficiency impact	
Solar photovoltaic panels	£242	0.19 kg/m ²	B 83	A 96
Wind turbine	£460	0.37 kg/m ²	B 85	A 97
Total Savings	£702	0.55 kg/m²		

Potential energy efficiency rating: B 85
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

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

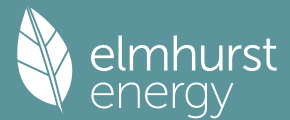
	Current	Potential	Saving
Electricity	£3354	£3354	£0
Space heating	£2778	£2778	£0
Water heating	£360	£360	£0
Lighting	£216	£216	£0
Generated (PV)	-£0	-£242	£242
Generated (wind)	-£0	-£460	£460
Total cost of fuels	£3354	£2652	£702
Total cost of uses	£3354	£2652	£702
Delivered energy	19 kWh/m ²	15 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	2.7 tonnes	2.2 tonnes	0.5 tonnes
CO2 emissions per m ²	3 kg/m ²	2 kg/m ²	1 kg/m ²
Primary energy	30 kWh/m ²	24 kWh/m ²	6 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2983.8452 (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													0 * 10 =	0.0000 (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) =													0.0000 / (5) =	0.0000 (8)
Pressure test														Yes
Pressure Test Method														Blower Door
Measured/design AP50														3.0000 (17)
Infiltration rate														0.1500 (18)
Number of sides sheltered														0 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.1500 (21)
													m3 per hour	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)	
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)	
Mechanical extract ventilation - centralised														
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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
Solid Door			2.1000	1.8000	3.7800		(26)
Half-glazed Door			10.7200	1.4000	15.0080		(26a)
Windows (Uw = 1.20)			36.9800	1.1450	42.3435		(27)
French Doors (Uw = 1.40)			22.9900	1.3258	30.4792		(27)
Bi-folding Doors (Uw = 1.40)			26.7900	1.3258	35.5170		(27)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			1.4400	1.1450	1.6489		(27a)
Roof Window			0.8500	1.1450	0.9733		(27a)
Basement Floor			209.5000	0.1200	25.1400	110.0000	23045.0000 (28)
Ground Floor			103.8300	0.1400	14.5362	75.0000	7787.2500 (28a)
Basement Wall	184.6500		184.6500	0.1700	31.3905	9.0000	1661.8500 (29a)
External Wall	611.6400	99.5800	512.0600	0.1200	61.4472	60.0000	30723.6000 (29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1300	41.1125	9.0000	2846.2500 (30)
Balcony Flat Roof	11.8700		11.8700	0.1300	1.5431	9.0000	106.8300 (30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1200	10.1124	9.0000	758.4300 (30)
Total net area of external elements Aum(A, m2)			1525.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	316.6806	(33)
Internal Wall - Masonry			615.1800			75.0000	46138.5000 (32c)
Internal Wall - Timber			642.0600			9.0000	5778.5400 (32c)
Internal Floor - 2F/1F			209.5000			18.0000	3771.0000 (32d)
Internal Floor - 1F/GF			190.9500			18.0000	3437.1000 (32d)
Internal Ceiling - GF/1F			209.5000			9.0000	1885.5000 (32e)
Internal Ceiling - 1F/2F			209.5000			9.0000	1885.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 129825.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 137.8437 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	51.5900	0.0240	1.2382
E3 Sill	45.6200	0.0270	1.2317
E4 Jamb	137.2600	0.0410	5.6277
R1 Head of roof window	3.0500	0.2400	0.7320
R2 Sill of roof window	3.0500	0.2400	0.7320
R3 Jamb of roof window	7.4000	0.2400	1.7760
E5 Ground floor (normal)	105.3000	0.0560	5.8968
E22 Basement floor	61.5500	0.2200	13.5410
E6 Intermediate floor within a dwelling	123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.5000	0.1000	0.8500
E11 Eaves (insulation at rafter level)	92.5500	0.0070	0.6479
E13 Gable (insulation at rafter level)	24.1000	0.0530	1.2773
E14 Flat roof	13.8000	0.1600	2.2080
E16 Corner (normal)	109.4400	0.0410	4.4870
E17 Corner (inverted - internal area greater than external area)	70.4800	-0.0570	-4.0174
R6 Flat ceiling	37.2000	0.1200	4.4640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			40.6922 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 357.3728 (37)

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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	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	(38)
Heat transfer coeff	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	(39)
Average = Sum(39)m / 12 =													849.7073
HLP	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	(40)
HLP (average)													0.9022
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													3.9663 (42)
Hot water usage for mixer showers	124.7429	122.8682	120.1365	114.9099	111.0527	106.7513	104.3063	107.0174	109.9892	114.6076	119.9466	124.2649	(42a)
Hot water usage for baths	39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044	(42b)
Hot water usage for other uses	55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490	(42c)
Average daily hot water use (litres/day)													201.5210 (43)
Daily hot water use	219.1285	214.6636	209.1043	200.3595	193.3632	185.7997	182.6779	188.2108	194.0766	202.0449	210.9331	218.5183	(44)
Energy content (annual)	347.0461	305.6781	321.3856	274.2821	260.3041	228.4624	220.9331	233.0442	239.3159	274.1730	300.5129	342.1468	(45)
Distribution loss (46)m = 0.15 x (45)m	52.0569	45.8517	48.2078	41.1423	39.0456	34.2694	33.1400	34.9566	35.8974	41.1260	45.0769	51.3220	(46)
Water storage loss:													500.0000 (47)
Store volume													1.1500 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.6210 (55)
Enter (49) or (54) in (55)													
Total storage loss	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(56)
If cylinder contains dedicated solar storage	19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	(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	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	(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	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	(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	149.4035	132.3573	140.8714	124.1124	120.5618	108.8773	107.4710	111.4979	112.4861	125.1733	132.8341	147.7745	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	166.5756	147.9510	120.3218	91.0913	68.0918	57.4860	62.1157	80.7403	108.3694	137.5999	160.5994	171.2052	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1311.0243	1324.6286	1290.3461	1217.3628	1125.2345	1038.6468	980.8010	967.1966	1001.4791	1074.4624	1166.5908	1253.1784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	(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)	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	(71)
Water heating gains (Table 5)	200.8112	196.9603	189.3433	172.3783	162.0455	151.2185	144.4502	149.8628	156.2307	168.2436	184.4919	198.6217	(72)
Total internal gains	1820.5014	1811.6302	1742.1016	1622.9228	1497.4621	1389.4417	1329.4572	1339.8901	1408.1696	1522.3963	1653.7724	1765.0957	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.4000	10.6334	0.6300	0.7000	0.7700	17.5484 (74)
East	12.4200	19.6403	0.6300	0.7000	0.7700	74.5488 (76)
South	11.0600	46.7521	0.6300	0.7000	0.7700	158.0257 (78)

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West	8.1000	19.6403	0.6300	0.7000	0.7700	48.6188 (80)
North	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
East	0.8500	26.0000	0.6300	0.7000	1.0000	8.7715 (82)
South	1.4400	26.0000	0.6300	0.7000	1.0000	14.8599 (82)
North	9.6000	10.6334	0.6300	0.7000	0.7700	31.1971 (74)
West	13.3900	19.6403	0.6300	0.7000	0.7700	80.3711 (80)
North	26.7900	10.6334	0.6300	0.7000	0.7700	87.0595 (74)

Solar gains	535.8608	996.4443	1568.5205	2259.3645	2798.7720	2891.0554	2740.8573	2324.8068	1807.4938	1158.2480	657.4906	448.2321 (83)
Total gains	2356.3622	2808.0745	3310.6221	3882.2873	4296.2341	4280.4971	4070.3145	3664.6969	3215.6635	2680.6442	2311.2630	2213.3277 (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	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412	42.4412
alpha	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294	3.8294
util living area	0.9991	0.9982	0.9952	0.9849	0.9533	0.8758	0.7580	0.8177	0.9521	0.9927	0.9984	0.9993 (86)
Living	19.2361	19.3724	19.6357	20.0010	20.3780	20.6792	20.8265	20.7897	20.5210	20.0411	19.5679	19.2038
Non living	18.0316	18.2063	18.5438	19.0103	19.4857	19.8480	20.0022	19.9706	19.6681	19.0634	18.4571	17.9901
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0
16 / 9	27	0	0	0	0	0	0	0	0	0	0	20
MIT	20.1299	19.3724	19.6357	20.0010	20.3780	20.6792	20.8265	20.7897	20.5210	20.0411	19.5679	19.7063 (87)
Th 2	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656 (88)
util rest of house	0.9990	0.9978	0.9941	0.9810	0.9390	0.8305	0.6635	0.7360	0.9312	0.9904	0.9981	0.9992 (89)
MIT 2	19.3452	18.2063	18.5438	19.0103	19.4857	19.8480	20.0022	19.9706	19.6681	19.0634	18.4571	18.7741 (90)
Living area fraction	fLA = Living area / (4) =											0.0918 (91)
MIT	19.4173	18.3134	18.6441	19.1013	19.5677	19.9243	20.0779	20.0458	19.7465	19.1532	18.5592	18.8598 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4173	18.3134	18.6441	19.1013	19.5677	19.9243	20.0779	20.0458	19.7465	19.1532	18.5592	18.8598 (93)

8. Space heating requirement

Utilisation	0.9988	0.9965	0.9912	0.9740	0.9255	0.8143	0.6519	0.7217	0.9167	0.9860	0.9969	0.9989 (94)
Useful gains	2353.4516	2798.1606	3281.5811	3781.2817	3976.0023	3485.5493	2653.2746	2644.8707	2947.7742	2643.2194	2304.1043	2210.8911 (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	12845.2839	11397.4903	10318.8911	8668.1413	6685.2064	4524.0936	2955.1939	3097.8800	4797.8386	7267.7250	9736.9300	12456.4990 (97)
Space heating kWh	7805.9232	5778.7496	5235.7586	3518.5389	2015.6479	0.0000	0.0000	0.0000	0.0000	3440.6322	5351.6345	7622.7323 (98a)
Space heating requirement - total per year (kWh/year)												40769.6171
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	7805.9232	5778.7496	5235.7586	3518.5389	2015.6479	0.0000	0.0000	0.0000	0.0000	3440.6322	5351.6345	7622.7323 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												40769.6171
Space heating per m2												(98c) / (4) = 43.2877 (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)
Fraction of main heating from main system 2												0.5000 (203)
Fraction of total heating from main system 1												0.5000 (204)
Fraction of total heating from main system 2												0.5000 (205)
Efficiency of main space heating system 1 (in %)												323.9624 (206)
Efficiency of main space heating system 2 (in %)												323.9624 (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	7805.9232	5778.7496	5235.7586	3518.5389	2015.6479	0.0000	0.0000	0.0000	0.0000	3440.6322	5351.6345	7622.7323 (98)
Space heating efficiency (main heating system 1)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (210)
Space heating fuel (main heating system)	1204.7578	891.8860	808.0813	543.0475	311.0929	0.0000	0.0000	0.0000	0.0000	531.0235	825.9655	1176.4843 (211)
Space heating efficiency (main heating system 2)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (212)
Space heating fuel (main heating system 2)	1204.7578	891.8860	808.0813	543.0475	311.0929	0.0000	0.0000	0.0000	0.0000	531.0235	825.9655	1176.4843 (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)
Space heating fuel used, main system 2												6292.3387 (213)
Water heating												
Water heating requirement	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602 (64)

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Efficiency of water heater (217)m	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557 (216)
Fuel for water heating, kWh/month	197.9915	174.8754	184.9497	160.3126	153.9053	137.0249	133.8952	140.0507	142.5412	160.9541	173.6442	195.5015	196.7557	196.7557 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	290.6249	262.4999	290.6249	281.2499	290.6249	281.2499	290.6249	290.6249	281.2499	290.6249	281.2499	290.6249	290.6249	290.6249 (231)
Lighting	145.8026	116.9683	105.3170	77.1597	59.6004	48.6940	54.3695	70.6715	91.7953	120.4404	136.0371	149.8549	149.8549	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-44.9153	-71.3441	-115.3740	-144.7993	-166.7862	-149.7154	-148.0278	-133.4115	-109.7989	-86.8640	-51.8517	-37.8969	-37.8969	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	(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	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	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	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	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	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	0.0000 (235d)	
Annual totals kWh/year														
Space heating fuel - main system 1														6292.3387 (211)
Space heating fuel - main system 2														6292.3387 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														196.7557
Water heating fuel used														1955.6463 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans: (MEVCentralised, DataSheet: in-use factor = 1.0000, SFP = 0.9400) mechanical ventilation fans (SFP = 0.9400)														3421.8737 (230a)
Total electricity for the above, kWh/year														3421.8737 (231)
Electricity for lighting (calculated in Appendix L)														1176.7108 (232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation														-1260.7851 (233)
Wind generation														-3575.5408 (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														15375.2446 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6292.3387	16.4900	1037.6067 (240)
Space heating - main system 2	6292.3387	16.4900	1037.6067 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1955.6463	16.4900	322.4861 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	3421.8737	16.4900	564.2670 (249)
Energy for lighting	1176.7108	16.4900	194.0396 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1260.7851	16.4900	-207.9035
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-207.9035 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	0.0000	5.5900	0.0000
Total			-412.7247 (252)
Total energy cost			2535.3778 (255)

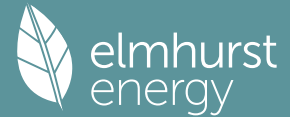
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.9249 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	85.0071
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6292.3387	0.1542	970.1407 (261)
Space heating - main system 2	6292.3387	0.1542	970.1407 (262)
Total CO2 associated with community systems			0.0000 (373)

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Water heating (other fuel)	1955.6463	0.1412	276.1480 (264)
Space and water heating			2216.4294 (265)
Pumps, fans and electric keep-hot	3421.8737	0.1387	474.6561 (267)
Energy for lighting	1176.7108	0.1443	169.8357 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1260.7851	0.1330	-167.6653
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-167.6653 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			2346.0757 (272)
CO2 emissions per m2			2.4900 (273)
EI value			96.8143
EI rating			97 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	209.5000 (1a)	x 3.0000 (2a)	= 628.5000 (1a) -
Ground floor	313.3300 (1b)	x 3.9400 (2b)	= 1234.5202 (1b) -
First floor	209.5000 (1c)	x 2.8000 (2c)	= 586.6000 (1c) -
Second floor	209.5000 (1d)	x 2.5500 (2d)	= 534.2250 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	941.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2983.8452 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.3000	3.8000	3.8000	3.3000	3.4000	3.5000	3.5000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0500	1.0750	0.9500	0.9500	0.8250	0.8500	0.8750	0.8750	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.1650	0.1575	0.1612	0.1425	0.1425	0.1237	0.1275	0.1313	0.1313	0.1388	0.1425	0.1500 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Solid Door			2.1000	1.8000	3.7800		(26)
Half-glazed Door			10.7200	1.4000	15.0080		(26a)

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Windows (Uw = 1.20)			36.9800	1.1450	42.3435			(27)
French Doors (Uw = 1.40)			22.9900	1.3258	30.4792			(27)
Bi-folding Doors (Uw = 1.40)			26.7900	1.3258	35.5170			(27)
Roof Window			1.4400	1.1450	1.6489			(27a)
Roof Window			1.4400	1.1450	1.6489			(27a)
Roof Window			0.8500	1.1450	0.9733			(27a)
Basement Floor			209.5000	0.1200	25.1400	110.0000	23045.0000	(28)
Ground Floor			103.8300	0.1400	14.5362	75.0000	7787.2500	(28a)
Basement Wall	184.6500		184.6500	0.1700	31.3905	9.0000	1661.8500	(29a)
External Wall	611.6400	99.5800	512.0600	0.1200	61.4472	60.0000	30723.6000	(29a)
Sloping Ceilings (Ins Rafter)	316.2500		316.2500	0.1300	41.1125	9.0000	2846.2500	(30)
Balcony Flat Roof	11.8700		11.8700	0.1300	1.5431	9.0000	106.8300	(30)
Main Flat Roof	88.0000	3.7300	84.2700	0.1200	10.1124	9.0000	758.4300	(30)
Total net area of external elements Aum(A, m2)			1525.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	316.6806			(33)
Internal Wall - Masonry			615.1800			75.0000	46138.5000	(32c)
Internal Wall - Timber			642.0600			9.0000	5778.5400	(32c)
Internal Floor - 2F/1F			209.5000			18.0000	3771.0000	(32d)
Internal Floor - 1F/GF			190.9500			18.0000	3437.1000	(32d)
Internal Ceiling - GF/1F			209.5000			9.0000	1885.5000	(32e)
Internal Ceiling - 1F/2F			209.5000			9.0000	1885.5000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 129825.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 137.8437 (35)

List of Thermal Bridges				
K1 Element		Length	Psi-value	Total
E2 Other lintels (including other steel lintels)		51.5900	0.0240	1.2382
E3 Sill		45.6200	0.0270	1.2317
E4 Jamb		137.2600	0.0410	5.6277
R1 Head of roof window		3.0500	0.2400	0.7320
R2 Sill of roof window		3.0500	0.2400	0.7320
R3 Jamb of roof window		7.4000	0.2400	1.7760
E5 Ground floor (normal)		105.3000	0.0560	5.8968
E22 Basement floor		61.5500	0.2200	13.5410
E6 Intermediate floor within a dwelling		123.8000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous		8.5000	0.1000	0.8500
E11 Eaves (insulation at rafter level)		92.5500	0.0070	0.6479
E13 Gable (insulation at rafter level)		24.1000	0.0530	1.2773
E14 Flat roof		13.8000	0.1600	2.2080
E16 Corner (normal)		109.4400	0.0410	4.4870
E17 Corner (inverted - internal area greater than external area)		70.4800	-0.0570	-4.0174
R6 Flat ceiling		37.2000	0.1200	4.4640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 40.6922 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 357.3728 (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	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345	492.3345
Heat transfer coeff	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073	849.7073
Average = Sum(39)m / 12 =												849.7073

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022	0.9022
HLP (average)												0.9022
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.9663	(42)
Hot water usage for mixer showers														
124.7429	122.8682	120.1365	114.9099	111.0527	106.7513	104.3063	107.0174	109.9892	114.6076	119.9466	124.2649	124.2649	(42a)	
Hot water usage for baths														
39.1367	38.5555	37.7370	36.2278	35.0977	33.8447	33.1679	33.9806	34.8656	36.2064	37.7466	39.0044	39.0044	(42b)	
Hot water usage for other uses														
55.2490	53.2399	51.2309	49.2218	47.2128	45.2037	45.2037	47.2128	49.2218	51.2309	53.2399	55.2490	55.2490	(42c)	
Average daily hot water use (litres/day)													201.5210	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	219.1285	214.6636	209.1043	200.3595	193.3632	185.7997	182.6779	188.2108	194.0766	202.0449	210.9331	218.5183	
Energy conte	347.0461	305.6781	321.3856	274.2821	260.3041	228.4624	220.9331	233.0442	239.3159	274.1730	300.5129	342.1468	
Energy content (annual)													Total = Sum(45)m = 3347.2843

Distribution loss (46)m = 0.15 x (45)m
 52.0569 45.8517 48.2078 41.1423 39.0456 34.2694 33.1400 34.9566 35.8974 41.1260 45.0769 51.3220 (46)

Water storage loss:
 Store volume 500.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.1500 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 0.6210 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
If cylinder contains dedicated solar storage												
19.2510	17.3880	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510	18.6300	19.2510	18.6300	19.2510	19.2510
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
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
Total heat required for water heating calculated for each month												
389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	384.6602
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
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

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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)		
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	384.6602	(64)
	Total per year (kWh/year) = Sum(64)m =											3847.8453	3847.8453	3847.8453	3847.8453	3847.8453	3847.8453	3847.8453	(64)							
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)							
Heat gains from water heating, kWh/month	149.4035	132.3573	140.8714	124.1124	120.5618	108.8773	107.4710	111.4979	112.4861	125.1733	132.8341	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	147.7745	(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	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	237.9785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	166.5756	147.9510	120.3218	91.0913	68.0918	57.4860	62.1157	80.7403	108.3694	137.5999	160.5994	171.2052	171.2052	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1311.0243	1324.6286	1290.3461	1217.3628	1125.2345	1038.6468	980.8010	967.1966	1001.4791	1074.4624	1166.5908	1253.1784	1253.1784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	62.7642	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	-158.6524	(71)
Water heating gains (Table 5)	200.8112	196.9603	189.3433	172.3783	162.0455	151.2185	144.4502	149.8628	156.2307	168.2436	184.4919	198.6217	198.6217	(72)
Total internal gains	1820.5014	1811.6302	1742.1016	1622.9228	1497.4621	1389.4417	1329.4572	1339.8901	1408.1696	1522.3963	1653.7724	1765.0957	1765.0957	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W								
North	5.4000	12.0101	0.6300	0.7000	0.7700	19.8205 (74)								
East	12.4200	22.3657	0.6300	0.7000	0.7700	84.8938 (76)								
South	11.0600	51.2899	0.6300	0.7000	0.7700	173.3640 (78)								
West	8.1000	22.3657	0.6300	0.7000	0.7700	55.3655 (80)								
North	1.4400	30.0000	0.6300	0.7000	1.0000	17.1461 (82)								
East	0.8500	30.0000	0.6300	0.7000	1.0000	10.1209 (82)								
South	1.4400	30.0000	0.6300	0.7000	1.0000	17.1461 (82)								
North	9.6000	12.0101	0.6300	0.7000	0.7700	35.2364 (74)								
West	13.3900	22.3657	0.6300	0.7000	0.7700	91.5240 (80)								
North	26.7900	12.0101	0.6300	0.7000	0.7700	98.3315 (74)								
Solar gains	602.9488	1029.4582	1577.4198	2345.9196	2831.7547	3115.1587	2935.3179	2531.6552	1972.2132	1256.7626	758.4600	499.1265	499.1265	(83)
Total gains	2423.4502	2841.0884	3319.5214	3968.8424	4329.2168	4504.6004	4264.7751	3871.5452	3380.3828	2779.1589	2412.2324	2264.2222	2264.2222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, ni1,m (see Table 9a)	0.9989	0.9979	0.9944	0.9798	0.9363	0.7928	0.6054	0.6646	0.9225	0.9893	0.9979	0.9992	0.9992	(86)
Living	19.3060	19.4253	19.7091	20.1069	20.4808	20.7869	20.8878	20.8745	20.6258	20.1503	19.6545	19.2714	19.2714	
Non living	18.1212	18.2742	18.6378	19.1450	19.6125	19.9618	20.0490	20.0417	19.7931	19.2028	18.5683	18.0768	18.0768	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	4	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	27	0	0	0	0	0	0	0	0	0	0	20	20	
MIT	20.1644	19.4253	19.7091	20.1069	20.4808	20.7869	20.8878	20.8745	20.6258	20.1503	19.6545	19.7550	19.7550	(87)
Th 2	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	20.1656	(88)
util rest of house	0.9987	0.9974	0.9931	0.9743	0.9156	0.7201	0.4743	0.5340	0.8874	0.9855	0.9973	0.9990	0.9990	(89)
MIT 2	19.3797	18.2742	18.6378	19.1450	19.6125	19.9618	20.0490	20.0417	19.7931	19.2028	18.5683	18.8296	18.8296	(90)
Living area fraction	19.4518	18.3799	18.7362	19.2334	19.6922	20.0376	20.1261	20.1182	19.8696	19.2898	18.6680	18.9146	18.9146	(91)
MIT	19.4518	18.3799	18.7362	19.2334	19.6922	20.0376	20.1261	20.1182	19.8696	19.2898	18.6680	18.9146	18.9146	(92)
Temperature adjustment												0.0000	0.0000	
adjusted MIT	19.4518	18.3799	18.7362	19.2334	19.6922	20.0376	20.1261	20.1182	19.8696	19.2898	18.6680	18.9146	18.9146	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9985	0.9960	0.9898	0.9657	0.9005	0.7070	0.4675	0.5256	0.8708	0.9796	0.9958	0.9987	0.9987	(94)
Useful gains	2419.7442	2829.6763	3285.5983	3832.7596	3898.4605	3184.8900	1993.6180	2034.9361	2943.6026	2722.5129	2402.1123	2261.1982	2261.1982	(95)

Full SAP Calculation Printout



Ext temp.	4.8000	5.3000	7.1000	9.7000	12.6000	15.7000	17.7000	17.6000	14.9000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	12449.7168	11114.1113	9887.3516	8100.5677	6026.3243	3685.6614	2061.4601	2139.7251	4222.7110	6704.0446	9319.6090	12078.2582 (97)
Space heating kWh	7462.2996	5567.1403	4911.7044	3072.8218	1583.1306	0.0000	0.0000	0.0000	0.0000	2962.2596	4980.5976	7303.8927 (98a)
Space heating requirement - total per year (kWh/year)												37843.8467
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	7462.2996	5567.1403	4911.7044	3072.8218	1583.1306	0.0000	0.0000	0.0000	0.0000	2962.2596	4980.5976	7303.8927 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												37843.8467
Space heating per m2												(98c) / (4) = 40.1812 (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)
Fraction of main heating from main system 2												0.5000 (203)
Fraction of total heating from main system 1												0.5000 (204)
Fraction of total heating from main system 2												0.5000 (205)
Efficiency of main space heating system 1 (in %)												323.9624 (206)
Efficiency of main space heating system 2 (in %)												323.9624 (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	7462.2996	5567.1403	4911.7044	3072.8218	1583.1306	0.0000	0.0000	0.0000	0.0000	2962.2596	4980.5976	7303.8927 (98)
Space heating efficiency (main heating system 1)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (210)
Space heating fuel (main heating system)	1151.7233	859.2264	758.0672	474.2560	244.3387	0.0000	0.0000	0.0000	0.0000	457.1920	768.7001	1127.2749 (211)
Space heating efficiency (main heating system 2)	323.9624	323.9624	323.9624	323.9624	323.9624	0.0000	0.0000	0.0000	0.0000	323.9624	323.9624	323.9624 (212)
Space heating fuel (main heating system 2)	1151.7233	859.2264	758.0672	474.2560	244.3387	0.0000	0.0000	0.0000	0.0000	457.1920	768.7001	1127.2749 (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)
Space heating fuel used, main system 2												5840.7785 (213)
Water heating												
Water heating requirement	389.5595	344.0773	363.8990	315.4241	302.8175	269.6044	263.4465	275.5576	280.4579	316.6864	341.6549	384.6602 (64)
Efficiency of water heater (217)m	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557	196.7557 (216)
Fuel for water heating, kWh/month	197.9915	174.8754	184.9497	160.3126	153.9053	137.0249	133.8952	140.0507	142.5412	160.9541	173.6442	195.5015 (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	290.6249	262.4999	290.6249	281.2499	290.6249	281.2499	290.6249	290.6249	281.2499	290.6249	281.2499	290.6249 (231)
Lighting	145.8026	116.9683	105.3170	77.1597	59.6004	48.6940	54.3695	70.6715	91.7953	120.4404	136.0371	149.8549 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.0842	-73.2218	-115.0480	-147.4875	-165.3911	-157.8349	-155.3122	-141.9396	-117.3348	-92.4947	-58.9674	-41.8921 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732 (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												5840.7785 (211)
Space heating fuel - main system 2												5840.7785 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												196.7557
Water heating fuel used												1955.6463 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVCentralised, DataSheet: in-use factor = 1.0000, SFP = 0.9400)												
mechanical ventilation fans (SFP = 0.9400)												3421.8737 (230a)
Total electricity for the above, kWh/year												3421.8737 (231)
Electricity for lighting (calculated in Appendix L)												1176.7108 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1317.0083 (233)
Wind generation												-3575.5408 (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												14415.9008 (238)

Full SAP Calculation Printout



10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5840.7785	18.3900	1074.1192 (240)
Space heating - main system 2	5840.7785	18.3900	1074.1192 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1955.6463	18.3900	359.6433 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	3421.8737	18.3900	629.2826 (249)
Energy for lighting	1176.7108	18.3900	216.3971 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1317.0083	18.3900	-242.1978
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-242.1978 (252)
Wind Turbine electricity used in dwelling	-2502.8785	18.3900	-460.2794
Wind Turbine electricity exported	0.0000	5.8100	0.0000
Total			-460.2794 (252)
Total energy cost			2651.0842 (255)

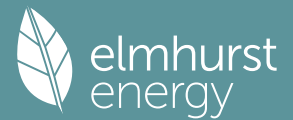
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5840.7785	0.1546	903.2603 (261)
Space heating - main system 2	5840.7785	0.1546	903.2603 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1955.6463	0.1412	276.1480 (264)
Space and water heating			2082.6687 (265)
Pumps, fans and electric keep-hot	3421.8737	0.1387	474.6561 (267)
Energy for lighting	1176.7108	0.1443	169.8357 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1317.0083	0.1330	-175.1076
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-175.1076 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-347.1801 (269)
Total CO2, kg/year			2204.8728 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5840.7785	1.5725	9184.8013 (275)
Space heating - main system 2	5840.7785	1.5725	9184.8013 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1955.6463	1.5221	2976.7714 (278)
Space and water heating			21346.3741 (279)
Pumps, fans and electric keep-hot	3421.8737	1.5128	5176.6105 (281)
Energy for lighting	1176.7108	1.5338	1804.8783 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1317.0083	1.4913	-1964.0522
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1964.0522 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	0.0000	0.0000	0.0000
Total			-3786.3546 (283)
Total Primary energy kWh/year			22577.4561 (286)

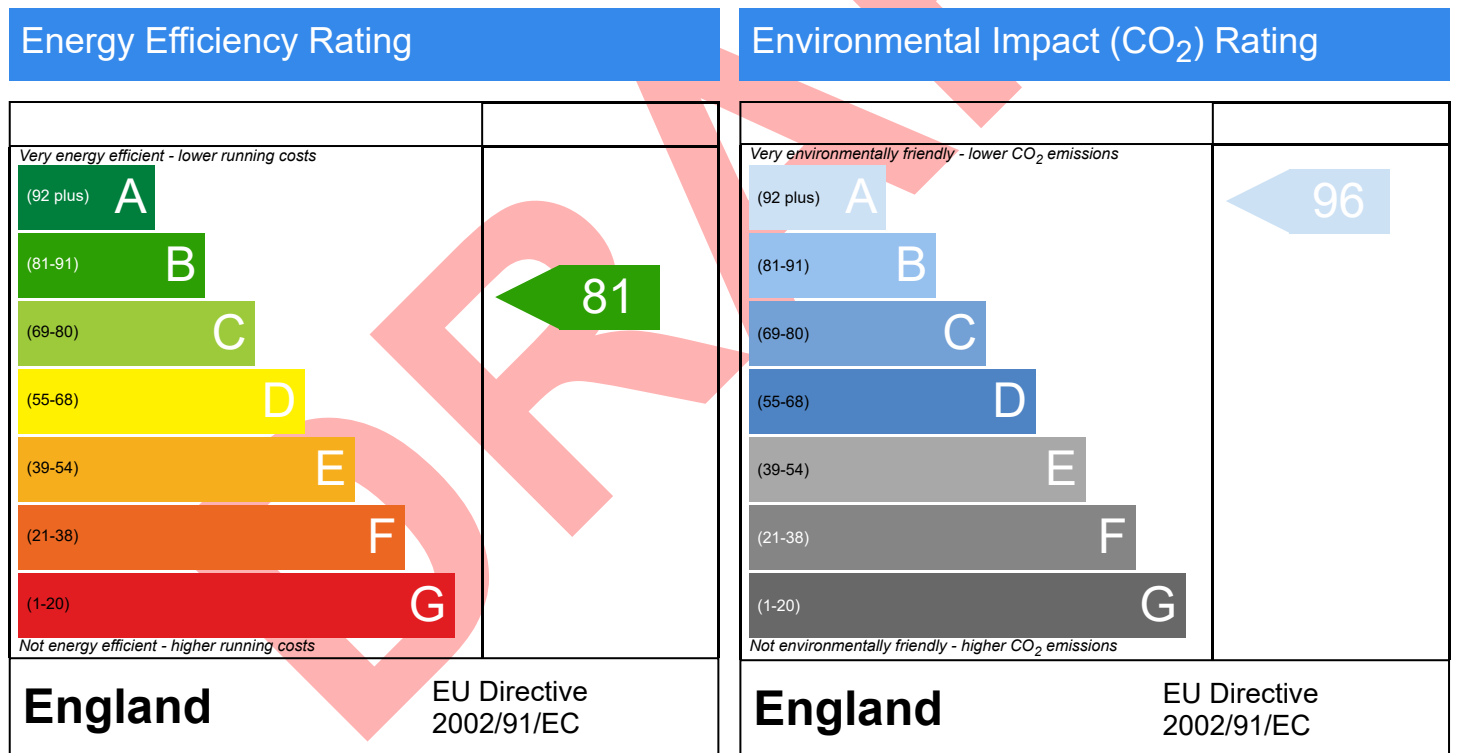
Predicted Energy Assessment



Highfields, Whempstead Road, Whempstead, SG12 0PG Dwelling type: House, Detached
 Date of assessment: 17/04/2023
 Produced by: Matthew Ray
 Total floor area: 941.83 m²
 DRRN:

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

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

Property Reference	BE15513	Issued on Date	17/04/2023
Assessment Reference	As Designed	Prop Type Ref	New Dwelling
Property	Highfields, Whempstead Road, Whempstead, SG12 0PG		

SAP Rating	81 B	DER	3.06	TER	9.50
Environmental	96 A	% DER < TER			67.79
CO ₂ Emissions (t/year)	2.73	DFEE	44.13	TFEE	46.78
Compliance Check	See BREL	% DFEE < TFEE			5.65
% DPER < TPER	37.20	DPER	31.75	TPER	50.55

Assessor Details	Mr. Matthew Ray	Assessor ID	T806-0001
Client	Alp Arikoglu, Alp Arikoglu		

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

Orientation	South
Property Tenure	ND
Transaction Type	6
Terrain Type	Rural
1.0 Property Type	House, Detached
2.0 Number of Storeys	4
3.0 Date Built	2023
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	61.55 m	209.50 m ²	3.00 m
Ground floor:	105.30 m	313.33 m ²	3.94 m
1st Storey:	61.90 m	209.50 m ²	2.80 m
2nd Storey:	61.90 m	209.50 m ²	2.55 m

8.0 Living Area	86.50	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	Basement Wall	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	0.17	9.00	184.65	184.65	0.00	None	0.00	Enter Gross Area
	External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.12	60.00	611.64	512.07	0.00	None	99.57	Enter Gross Area

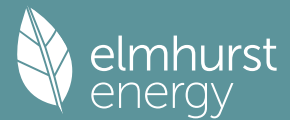
9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall - Masonry	Dense block, plasterboard on dabs	75.00	615.18
	Internal Wall - Timber	Plasterboard on timber frame	9.00	642.06

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Sloping Ceilings (Ins Rafter)	External Slope Roof	Plasterboard, insulated slope	0.13	9.00	316.25	0.00	None	0.00	Enter Gross Area	0.00
	Balcony Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.13	9.00	11.87	0.00	None	0.00	Enter Gross Area	0.00
	Main Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.12	9.00	88.00	3.73	None	0.00	Enter Gross Area	3.73

10.2 Internal Ceilings	Description	Storey	Construction	Area (m ²)
	Internal Ceiling - GF/1F	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	209.50
	Internal Ceiling - 1F/2F	+1	Plasterboard ceiling, carpeted chipboard floor	209.50

11.0 Heat Loss Floors

Summary for Input Data



Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Basement Floor	Basement Floor	Basement	Slab on ground, screed over insulation	0.12	None	0.00	110.00	209.50
Ground Floor	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.14	None	0.00	75.00	103.83

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor - 2F/1F		Plasterboard ceiling, carpeted chipboard floor	9.00	209.50
Internal Floor - 1F/GF		Plasterboard ceiling, carpeted chipboard floor	9.00	190.95

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Solid Door	Manufacturer	Solid Door							1.80
Half-glazed Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.20
French Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Bi-folding Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Entrance Door	Solid Door	External Wall	South	2.10	
Entrance Glazing	Windows	External Wall	South	2.52	
Ground Floor	Windows	External Wall	South	6.59	
First Floor	Windows	External Wall	South	1.95	
Annexe Entrance	Half-glazed Door	External Wall	South	4.51	
Ground Floor	French Doors	External Wall	West	13.39	
Ground Floor	Windows	External Wall	West	2.55	
First Floor	Windows	External Wall	West	4.50	
First Floor	Windows	External Wall	West	1.05	
Ground Floor	Bi-folding Doors	External Wall	North	26.79	
Balcony Doors	French Doors	External Wall	North	9.60	
First Floor	Windows	External Wall	North	1.50	
Annexe Entrance	Half-glazed Door	External Wall	North	4.51	
Annexe	Windows	External Wall	North	3.90	
Side Entrance	Half-glazed Door	External Wall	East	1.70	
Side Ent Glazing	Windows	External Wall	East	0.43	
Ground Floor	Windows	External Wall	East	2.38	
First Floor	Windows	External Wall	East	6.60	
Annexe	Windows	External Wall	East	3.00	
Roof Window	Roof Windows	Main Flat Roof	South	1.44	0
Roof Window	Roof Windows	Main Flat Roof	North	1.44	0
Roof Window	Roof Windows	Main Flat Roof	East	0.84	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	51.59	0.02	0.02 CBA-213	Yes
E3 Sill	Independently assessed	45.62	0.03	0.03 CBA-214	Yes
E4 Jamb	Independently assessed	137.26	0.04	0.04 CBA-215	Yes
R1 Head of roof window	Table K1 - Default	3.05	0.24	0.24	Yes
R2 Sill of roof window	Table K1 - Default	3.05	0.24	0.24	Yes
R3 Jamb of roof window	Table K1 - Default	7.40	0.24	0.24	Yes
E5 Ground floor (normal)	Independently assessed	105.30	0.06	0.06 CBA-201	No
E22 Basement floor	Table K1 - Default	61.55	0.22	0.22	No
E6 Intermediate floor within a dwelling	Independently assessed	123.80	0.00	0.00 CBA-203	No
E8 Balcony within a dwelling, wall insulation continuous	Table K1 - Default	8.50	0.10	0.10	No
E11 Eaves (insulation at rafter level)	Independently assessed	92.55	0.01	0.01 CBA-209	No
E13 Gable (insulation at rafter level)	Independently assessed	24.10	0.05	0.05 CBA-211	No
E14 Flat roof	Table K1 - Default	13.80	0.16	0.16	No
E16 Corner (normal)	Independently assessed	109.44	0.04	0.04 CBA-216	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	70.48	-0.06	-0.06 CBA-217	No
R6 Flat ceiling	Table K1 - Default	37.20	0.12	0.12	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

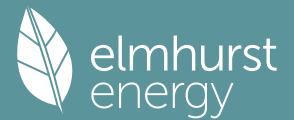
Test Method

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Summary for Input Data



Mechanical Ventilation data Type	Data Sheet
Type	Mechanical extract ventilation - centralised
Configuration	4
Manufacturer SFP	0.94
Duct Type	Rigid
Wet Rooms	8
Brand, Model	Various

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
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22.0 Lighting

No Fixed Lighting	No
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Name	Efficacy	Power	Capacity	Count
Ceiling Light Bulbs	66.90	10	670	50

24.0 Main Heating 1

Database	
Percentage of Heat	50.00 %
Database Ref. No.	105460
Fuel Type	Electricity
In Winter	0.00
In Summer	0.00
Model Name	Vitocal 300-G
Manufacturer	Viessmann Ltd
System Type	Heat Pump
Controls SAP Code	2207
Heating Pump Age	2013 or later
Heat Emitter	Radiators and Underfloor
Flow Temperature	Enter value
Flow Temperature Value	45.00

25.0 Main Heating 2

Database	
Percentage of Heat	50.00 %
Database Ref. No.	105460
Fuel Type	Electricity
In Winter	0.00
In Summer	0.00
Model Name	Vitocal 300-G
Manufacturer	Viessmann Ltd
Controls	2100
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Enter value

26.0 Heat Networks

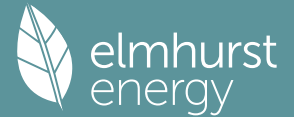
None

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

28.0 Water Heating

Water Heating	Main Heating 2
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Summary for Input Data



SAP Code	914
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	3
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
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28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder	
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	500.00 L
Loss	1.15 kWh/day
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

None

34.0 Small-scale Hydro

None											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
£3,500 - £5,500	£242	B 82	A 96
£15,000 - £25,000	£460	B 83	A 96
		B 85	A 97

Thermal Bridging



Property Reference	BE15513	Issued on Date	17/04/2023
Assessment Reference	As Designed	Prop Type Ref	Detached House
Property	Highfields, Whempstead Road, Whempstead, SG12 0PG		

SAP Rating	81 B	DER	3.06	TER	9.50
Environmental	96 A	% DER < TER			67.79
CO ₂ Emissions (t/year)	2.73	DFEE	44.13	TFEE	46.78
Compliance Check	See BREL	% DFEE < TFEE			5.65
% DPER < TPER	37.20	DPER	31.75	TPER	50.55

Assessor Details	Mr. Matthew Ray	Assessor ID	T806-0001
Client	Alp Arikoglu, Alp Arikoglu		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.024	51.59	1.24	CBA-213
External wall	E3 Sill	Independently assessed	0.027	45.62	1.23	CBA-214
External wall	E4 Jamb	Independently assessed	0.041	137.26	5.63	CBA-215
External roof	R1 Head of roof window	Table K1 - Default	0.240	3.05	0.73	
External roof	R2 Sill of roof window	Table K1 - Default	0.240	3.05	0.73	
External roof	R3 Jamb of roof window	Table K1 - Default	0.240	7.40	1.78	
External wall	E5 Ground floor (normal)	Independently assessed	0.056	105.30	5.90	CBA-201
External wall	E22 Basement floor	Table K1 - Default	0.220	61.55	13.54	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	123.80	0.00	CBA-203
External wall	E8 Balcony within a dwelling, wall insulation continuous	Table K1 - Default	0.100	8.50	0.85	
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.007	92.55	0.65	CBA-209
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.053	24.10	1.28	CBA-211
External wall	E14 Flat roof	Table K1 - Default	0.160	13.80	2.21	
External wall	E16 Corner (normal)	Independently assessed	0.041	109.44	4.49	CBA-216
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.057	70.48	-4.02	CBA-217
External roof	R6 Flat ceiling	Table K1 - Default	0.120	37.20	4.46	

Total: W/mK:
 Y-Value: W/m²K:

Dwelling Address	Highfields, Whempstead Road, Whempstead, SG12 0PG
Report Date	17/04/2023
Property Type	House, Detached
Floor Area [m ²]	942

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

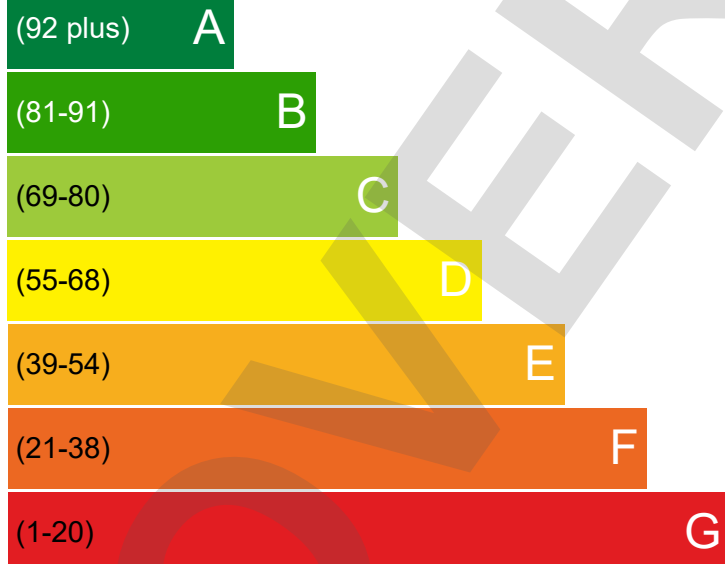
Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL



81

85

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.13 W/m ² K	Very Good
Roof	Average thermal transmittance 0.13 W/m ² K	Very Good
Floor	Average thermal transmittance 0.13 W/m ² K	Very Good
Windows	High performance glazing	Good
Main heating	Ground source heat pump, radiators and underfloor, electric	Very Good
Main heating	Ground source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Main heating controls	Not applicable (heating provides DHW only)	
Secondary heating	None	
Hot water	From main system	Average
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 30 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling







The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **2.7** per year

With the recommended measures the potential CO emissions could be: **2.2** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating		 1	£59	 B 82
Photovoltaic	£242	 1	£301	 B 83
Wind turbine	£460	 3	£761	 B 85

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£3354

Over a year you could save

£702

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details

Assessor name	Mr. Matthew Ray
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	14/04/2023
Date of certificate	14/04/2023
Type of assessment	SAP, new dwelling