

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	069 - PRJ013014			Issued on Date	14/04/2025
Assessment Reference	069	Prop Type Ref	B		
Property	3 Caveney View, Netley Abbey, SOUTHAMPTON, SO31 5JR				
SAP Rating	85 B	DER	14.52	TER	17.64
Environmental	87 B	% DER<TER	17.69		
CO ₂ Emissions (t/year)	1.36	DFEE	48.14	TFEE	56.49
General Requirements Compliance	Pass	% DFEE<TFEE	14.78		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

FULL SAP CALCULATION PRINTOUT

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 112 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.64 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.78 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)

Combi boiler

Efficiency: 89.3% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average

Windows facing North: 8.17 m², No overhang

Windows facing South: 9.25 m², No overhang

Air change rate: 4.70 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.08 W/m²K

Air permeability 3.8 m³/m²h

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Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1791 (8)
Pressure test					Yes
Measured/design AP50					3.7800
Infiltration rate					0.3681 (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) =	0.3681 (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	0.4693	0.4601	0.4509	0.4049	0.3957	0.3497	0.3497	0.3405	0.3681	0.3957	0.4141	0.4325 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5820	0.5783	0.5611	0.5611	0.5580	0.5677	0.5783	0.5857	0.5935 (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			1.9000	1.2000	2.2800		(26)
Half Glazed Door			2.0900	1.4000	2.9260		(26a)
Windows (Uw = 1.40)			17.4200	1.3258	23.0947		(27)
Flr - Ground			55.9640	0.1800	10.0735	75.6000	4230.8784 (28a)
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.2100	27.2391	7.4000	959.8540 (29a)
Rf - Ins Joist	55.9640		55.9640	0.0800	4.4771	7.4000	414.1336 (30)
Total net area of external elements Aum(A, m ²)			263.0480				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0904		(33)
Stud			100.9904			7.4000	747.3293 (32c)
Internal Floor			55.9640			7.4000	414.1336 (32d)
Internal Ceiling			55.9640			7.4000	414.1336 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7180.4625 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.1571 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3336 (36)
Total fabric heat loss							(33) + (36) = 89.4240 (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	56.2211	55.8271	55.4409	53.6269	53.2876	51.7077	51.7077	51.4151	52.3162	53.2876	53.9741	54.6919 (38)
Heat transfer coeff	145.6451	145.2511	144.8649	143.0510	142.7116	141.1317	141.1317	140.8391	141.7403	142.7116	143.3982	144.1159 (39)
Average = Sum(39)m / 12 =												143.0494 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3013	1.2978	1.2944	1.2782	1.2751	1.2610	1.2610	1.2584	1.2664	1.2751	1.2813	1.2877 (40)
HLP (average)												1.2781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4459	107.3933	103.3408	99.2882	95.2356	91.1830	91.1830	95.2356	99.2882	103.3408	107.3933	111.4459 (44)
Energy conte	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Energy content (annual)										Total = Sum(45)m =		1594.0712 (45)
Distribution loss (46)m = 0.15 x (45)m												

	24.7907	21.6821	22.3740	19.5062	18.7166	16.1510	14.9663	17.1740	17.3792	20.2537	22.1085	24.0084 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6694	0.6089	0.6525	0.5810	0.5347	0.4418	0.4094	0.4907	0.5177	0.5906	0.6208	0.6483 (61)
Total heat required for water heating calculated for each month	165.9405	145.1560	149.8122	130.6221	125.3122	108.1153	100.1847	114.9843	116.3787	135.6155	148.0111	160.7045 (62)
WWHRS	-55.0538	-48.4415	-49.4402	-40.6697	-37.7584	-31.1459	-26.3543	-31.9108	-32.8442	-40.6077	-47.0466	-53.2138 eq. (G10)
Total of WWHRS savings												-494.4869
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 (63)
Output from w/h								Solar input (sum of months) =	Sum(63)m =			0.0000 (63)
	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
								Total per year (kWh/year) =	Sum(64)m =			1106.3501 (64)
Heat gains from water heating, kWh/month	55.1200	48.2141	49.7587	43.3839	41.6222	35.9119	33.2776	38.1918	38.6532	45.0434	49.1625	53.3808 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5090	22.6569	18.4258	13.9495	10.4274	8.8033	9.5123	12.3644	16.5955	21.0718	24.5939	26.2180 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.2862	277.1324	269.9600	254.6908	235.4161	217.3007	205.1984	202.3522	209.5246	224.7938	244.0685	262.1839 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349 (71)
Water heating gains (Table 5)	74.0860	71.7472	66.8800	60.2554	55.9438	49.8776	44.7280	51.3331	53.6850	60.5422	68.2812	71.7483 (72)
Total internal gains	442.2693	439.9246	423.6539	397.2838	370.1755	344.3697	327.8268	334.4377	348.1932	374.7959	405.3316	428.5384 (73)

[Jan					Area	Solar flux		g	FF	Access		Gains
					m ²	Table 6a	W/m ²	Specific data	Specific data	factor	W	
								or Table 6b	or Table 6c	Table 6d		
North					8.1710	10.6334		0.7300	0.7200	0.7700	31.6472	
South					9.2460	46.7521		0.7300	0.7200	0.7700	157.4502 (78)	
Solar gains	189.0974	318.3424	431.2410	536.3182	609.2292	610.3530	586.0126	529.5903	466.6895	350.1222	225.6731	162.4342 (83)
Total gains	631.3667	758.2670	854.8949	933.6020	979.4047	954.7227	913.8394	864.0281	814.8827	724.9182	631.0047	590.9725 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.6947	13.7319	13.7685	13.9431	13.9762	14.1327	14.1327	14.1621	14.0720	13.9762	13.9093	13.8401
alpha	1.9130	1.9155	1.9179	1.9295	1.9317	1.9422	1.9422	1.9441	1.9381	1.9317	1.9273	1.9227
util living area	0.9428	0.9188	0.8860	0.8326	0.7529	0.6417	0.5281	0.5623	0.7178	0.8540	0.9229	0.9489 (86)
MIT	17.5075	17.8737	18.4386	19.1682	19.8656	20.4374	20.7322	20.6860	20.2410	19.3359	18.2936	17.4416 (87)
Th 2	19.8398	19.8425	19.8453	19.8580	19.8604	19.8715	19.8715	19.8736	19.8672	19.8604	19.8555	19.8505 (88)
util rest of house	0.9357	0.9090	0.8715	0.8095	0.7142	0.5754	0.4286	0.4662	0.6607	0.8291	0.9119	0.9427 (89)
MIT 2	15.2578	15.7776	16.5787	17.6082	18.5695	19.3276	19.6757	19.6317	19.0894	17.8606	16.3865	15.1660 (90)
Living area fraction	15.6833	16.1741	16.9305	17.9033	18.8146	19.5376	19.8755	19.8311	19.3072	18.1396	16.7472	15.9646 (92)
MIT	15.6833	16.1741	16.9305	17.9033	18.8146	19.5376	19.8755	19.8311	19.3072	18.1396	16.7472	15.9646 (92)
Temperature adjustment	15.5333	16.0241	16.7805	17.7533	18.6646	19.3876	19.7255	19.6811	19.1572	17.9896	16.5972	15.4500
adjusted MIT	15.5333	16.0241	16.7805	17.7533	18.6646	19.3876	19.7255	19.6811	19.1572	17.9896	16.5972	15.4464 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8940	0.8600	0.8168	0.7530	0.6637	0.5421	0.4140	0.4473	0.6166	0.7727	0.8638	0.9036 (94)
Useful gains	564.4621	652.0895	698.3060	702.9647	650.0764	517.5989	378.2870	386.4487	502.4723	560.1684	545.0868	534.0160 (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	1636.0765	1615.7844	1489.2859	1266.4717	993.9324	675.6762	441.1109	462.1122	716.8064	1054.5883	1361.8865	1620.7901 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	797.2811	647.6030	588.4890	405.7250	255.8289	0.0000	0.0000	0.0000	0.0000	367.8484	588.0958	808.5599 (98)
Space heating												4459.4312 (98)
Space heating per m2												39.8448 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4943.9370 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	797.2811	647.6030	588.4890	405.7250	255.8289	0.0000	0.0000	0.0000	0.0000	367.8484	588.0958	808.5599 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	883.9037	717.9634	652.4268	449.8060	283.6240	0.0000	0.0000	0.0000	0.0000	407.8142	651.9910	896.4079 (211)
Water heating 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 (215)
Water heating requirement	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
Efficiency of water heater (217)m	88.2536	88.1315	87.8869	87.3372	86.2287	76.4000	76.4000	76.4000	76.4000	86.9753	87.8743	76.4000 (216)
Fuel for water heating, kWh/month	125.6455	109.7389	114.2059	102.9944	101.5367	100.7453	96.6366	108.7349	109.3383	109.2354	114.8965	121.6951 (219)
Water heating fuel used												1315.4035 (219)
Annual totals kWh/year												
Space heating fuel - main system												4943.9370 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												450.4976 (232)
Total delivered energy for all uses												6784.8381 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	4943.9370	0.2160	1067.8904 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1315.4035	0.2160	284.1272 (264)
Space and water heating			1352.0175 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.4976	0.5190	233.8082 (268)
Total CO ₂ , kg/year			1624.7508 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5200 (273)

16 CO₂ EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.5200 ZC1
Total Floor Area	TFA	111.9200
Assumed number of occupants	N	2.8259
CO ₂ emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO ₂ emissions from appliances, equation (L14)		14.5225 ZC2
CO ₂ emissions from cooking, equation (L16)		1.6692 ZC3
Total CO ₂ emissions		30.7118 ZC4
Residual CO ₂ emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000 ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO ₂ emissions		30.7118 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1432 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3932 (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) =		0.3932 (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	0.5014	0.4916	0.4817	0.4326	0.4227	0.3736	0.3736	0.3638	0.3932	0.4227	0.4424	0.4621 (22b)
Effective ac	0.6257	0.6208	0.6160	0.5936	0.5894	0.5698	0.5698	0.5662	0.5773	0.5894	0.5979	0.6068 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9000	1.0000	1.9000		(26)
TER Semi-glazed door			2.0900	1.2000	2.5080		(26a)
TER Opening Type (Uw = 1.40)			17.4200	1.3258	23.0947		(27)
Flr - Ground			55.9640	0.1300	7.2753		(28a)
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.1800	23.3478		(29a)
Rf - Ins Joist	55.9640		55.9640	0.1300	7.2753		(30)
Total net area of external elements Aum(A, m ²)			263.0480				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.4011		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3744 (36)
Total fabric heat loss						(33) + (36) =	76.7755 (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	57.6574	57.2076	56.7668	54.6960	54.3086	52.5051	52.5051	52.1711	53.1998	54.3086	55.0924	55.9117 (38)
Heat transfer coeff	134.4329	133.9832	133.5423	131.4716	131.0841	129.2806	129.2806	128.9466	129.9753	131.0841	131.8679	132.6873 (39)
Average = Sum(39)m / 12 =												131.4697 (39)
HLP	1.2012	1.1971	1.1932	1.1747	1.1712	1.1551	1.1551	1.1521	1.1613	1.1712	1.1782	1.1856 (40)
HLP (average)												1.1747 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.4459	107.3933	103.3408	99.2882	95.2356	91.1830	91.1830	95.2356	99.2882	103.3408	107.3933	111.4459 (44)
Energy content (annual)	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7907	21.6821	22.3740	19.5062	18.7166	16.1510	14.9663	17.1740	17.3792	20.2537	22.1085	24.0084 (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	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	50.9589	46.0274	50.9589	48.9640	48.5310	44.9670	46.4659	48.5310	48.9640	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	216.2300	190.5745	200.1186	179.0051	173.3085	152.6404	146.2412	163.0246	164.8251	185.9838	196.7053	211.0151 (62)
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 (63)
Output from w/h	216.2300	190.5745	200.1186	179.0051	173.3085	152.6404	146.2412	163.0246	164.8251	185.9838	196.7053	211.0151 (64)
Heat gains from water heating, kWh/month	67.6924	59.5688	62.3353	55.4797	53.6213	47.0432	44.7918	50.2019	50.7648	57.6355	61.3360	65.9584 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936	141.2936 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6534	22.7851	18.5301	14.0285	10.4864	8.8531	9.5661	12.4344	16.6894	21.1910	24.7330	26.3664 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.2862	277.1324	269.9600	254.6908	235.4161	217.3007	205.1984	202.3522	209.5246	224.7938	244.0685	262.1839 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294	37.1294 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349 (71)
Water heating gains (Table 5)	90.9844	88.6440	83.7840	77.0551	72.0716	65.3377	60.2040	67.4757	70.5067	77.4671	85.1889	88.6538 (72)
Total internal gains	459.3120	456.9496	440.6622	414.1624	386.3622	359.8796	343.3566	350.6503	365.1087	391.8400	422.3785	445.5922 (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				8.1710	10.6334	0.6300		0.7000		0.7700		26.5533 (74)
South				9.2460	46.7521	0.6300		0.7000		0.7700		132.1072 (78)
Solar gains	158.6605	267.1023	361.8289	449.9930	511.1683	512.1113	491.6887	444.3481	391.5716	293.7669	189.3490	136.2889 (83)
Total gains	617.9725	724.0519	802.4911	864.1554	897.5306	871.9909	835.0453	794.9984	756.6804	685.6069	611.7275	581.8811 (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	57.8149	58.0090	58.2005	59.1171	59.2919	60.1190	60.1190	60.2747	59.7977	59.2919	58.9395	58.5755
alpha	4.8543	4.8673	4.8800	4.9411	4.9528	5.0079	5.0079	5.0183	4.9865	4.9528	4.9293	4.9050
util living area	0.9986	0.9967	0.9920	0.9770	0.9310	0.8109	0.6459	0.6935	0.8951	0.9832	0.9970	0.9990 (86)
MIT	19.6466	19.8057	20.0506	20.3764	20.6794	20.8992	20.9753	20.9649	20.8162	20.4239	19.9789	19.6261 (87)
Th 2	19.9191	19.9223	19.9254	19.9403	19.9431	19.9561	19.9561	19.9585	19.9511	19.9431	19.9375	19.9316 (88)
util rest of house	0.9981	0.9956	0.9890	0.9673	0.8990	0.7253	0.5100	0.5611	0.8350	0.9743	0.9958	0.9986 (89)
MIT 2	18.1134	18.3480	18.7070	19.1871	19.6080	19.8825	19.9462	19.9428	19.7933	19.2615	18.6123	18.0922 (90)
Living area fraction	18.4034	18.6238	18.9611	19.4121	19.8107	20.0748	20.1409	20.1361	19.9868	19.4814	18.8708	0.1892 (91)
MIT	18.4034	18.6238	18.9611	19.4121	19.8107	20.0748	20.1409	20.1361	19.9868	19.4814	18.8708	18.3823 (92)
Temperature adjustment	18.4034	18.6238	18.9611	19.4121	19.8107	20.0748	20.1409	20.1361	19.9868	19.4814	18.8708	0.0000
adjusted MIT	18.4034	18.6238	18.9611	19.4121	19.8107	20.0748	20.1409	20.1361	19.9868	19.4814	18.8708	18.3823 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	616.1657	719.3291	790.4991	830.2550	802.3719	642.1684	447.2950	465.5985	633.7587	664.2231	607.9488	580.6097 (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	1895.9582	1838.7521	1664.0851	1382.0360	1063.1798	707.7838	457.7686	481.7621	765.1355	1164.2044	1552.1957	1881.8160 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	952.1656	752.2522	649.9480	397.2823	194.0411	0.0000	0.0000	0.0000	0.0000	371.9861	679.8578	968.0975 (98)
Space heating												4965.6307 (98)
Space heating per m2												(98) / (4) = 44.3677 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5316.5211 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	952.1656	752.2522	649.9480	397.2823	194.0411	0.0000	0.0000	0.0000	0.0000	371.9861	679.8578	968.0975	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1019.4493	805.4092	695.8758	425.3557	207.7528	0.0000	0.0000	0.0000	0.0000	398.2721	727.8991	1036.5070	(211)
Water heating 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	(215)
Water heating requirement	216.2300	190.5745	200.1186	179.0051	173.3085	152.6404	146.2412	163.0246	164.8251	185.9838	196.7053	211.0151	(64)
Efficiency of water heater (217)m	88.3436	88.1587	87.8002	87.0010	85.3362	80.3000	80.3000	80.3000	80.3000	86.7625	87.9185	80.3000	(216)
Fuel for water heating, kWh/month	244.7602	216.1722	227.9249	205.7507	203.0892	190.0877	182.1185	203.0195	205.2616	214.3596	223.7360	238.6780	(219)
Water heating fuel used												2554.9582	(219)
Annual totals kWh/year													
Space heating fuel - main system												5316.5211	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												453.0466	(232)
Total delivered energy for all uses												8399.5259	(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	5316.5211	0.2160	1148.3686 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2554.9582	0.2160	551.8710 (264)
Space and water heating			1700.2395 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.0466	0.5190	235.1312 (268)
Total CO2, kg/m2/year			1974.2957 (272)
Emissions per m2 for space and water heating			15.1916 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1009 (272b)
Emissions per m2 for pumps and fans			0.3478 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1916 * 1.00) + 2.1009 + 0.3478, rounded to 2 d.p.			17.6400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1791 (8)
Pressure test					Yes
Measured/design AP50					3.7800
Infiltration rate					0.3681 (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) =	0.3681 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4509	0.4233	0.4141	0.3865	0.3865	0.3773	0.3773	0.3681	0.3681	0.3957	0.3957	0.4049 (22b)
Effective ac	0.6016	0.5896	0.5857	0.5747	0.5747	0.5712	0.5712	0.5677	0.5677	0.5783	0.5783	0.5820 (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			1.9000	1.2000	2.2800		(26)
Half Glazed Door			2.0900	1.4000	2.9260		(26a)
Windows (Uw = 1.40)			17.4200	1.3258	23.0947		(27)
Flr - Ground			55.9640	0.1800	10.0735	75.6000	4230.8784 (28a)
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.2100	27.2391	7.4000	959.8540 (29a)
Rf - Ins Joist	55.9640		55.9640	0.0800	4.4771	7.4000	414.1336 (30)
Total net area of external elements Aum(A, m ²)			263.0480				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0904		(33)
Stud			100.9904			7.4000	747.3293 (32c)
Internal Floor			55.9640			7.4000	414.1336 (32d)
Internal Ceiling			55.9640			7.4000	414.1336 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7180.4625 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.1571 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3336 (36)
Total fabric heat loss							(33) + (36) = 89.4240 (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	55.4409	54.3291	53.9741	52.9560	52.9560	52.6322	52.6322	52.3162	52.3162	53.2876	53.2876	53.6269 (38)
Heat transfer coeff	144.8649	143.7532	143.3982	142.3800	142.3800	142.0562	142.0562	141.7403	141.7403	142.7116	142.7116	143.0510 (39)
Average = Sum(39)m / 12 =												142.7370 (39)
HLP	1.2944	1.2844	1.2813	1.2722	1.2722	1.2693	1.2693	1.2664	1.2664	1.2751	1.2751	1.2782 (40)
HLP (average)												1.2753 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.4459	107.3933	103.3408	99.2882	95.2356	91.1830	91.1830	95.2356	99.2882	103.3408	107.3933	111.4459 (44)
Energy conte	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Energy content (annual)												Total = Sum(45)m = 1594.0712 (45)
Distribution loss (46)m = 0.15 x (45)m												

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CALCULATION OF HEAT DEMAND 09 Jan 2014

	24.7907	21.6821	22.3740	19.5062	18.7166	16.1510	14.9663	17.1740	17.3792	20.2537	22.1085	24.0084 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6694	0.6089	0.6525	0.5810	0.5347	0.4418	0.4094	0.4907	0.5177	0.5906	0.6208	0.6483 (61)
Total heat required for water heating calculated for each month	165.9405	145.1560	149.8122	130.6221	125.3122	108.1153	100.1847	114.9843	116.3787	135.6155	148.0111	160.7045 (62)
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 (63)
Output from w/h	165.9405	145.1560	149.8122	130.6221	125.3122	108.1153	100.1847	114.9843	116.3787	135.6155	148.0111	160.7045 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	55.1200	48.2141	49.7587	43.3839	41.6222	35.9119	33.2776	38.1918	38.6532	45.0434	49.1625	53.3808 (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	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7726	56.6423	46.0646	34.8738	26.0686	22.0082	23.7807	30.9110	41.4887	52.6794	61.4846	65.5450 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.3823	413.6304	402.9253	380.1355	351.3673	324.3293	306.2663	302.0182	312.7233	335.5132	364.2813	391.3193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349 (71)
Water heating gains (Table 5)	74.0860	71.7472	66.8800	60.2554	55.9438	49.8776	44.7280	51.3331	53.6850	60.5422	68.2812	71.7483 (72)
Total internal gains	661.5395	656.3185	630.1685	589.5633	547.6783	510.5137	489.0735	498.5608	522.1956	563.0334	608.3457	642.9112 (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					8.1710	13.4684	0.7300	0.7200			0.7700	40.0849 (74)
South					9.2460	56.5862	0.7300	0.7200			0.7700	190.5694 (78)
Solar gains	230.6542	330.6751	458.0026	580.5983	628.3084	698.0325	646.5672	603.6145	524.4174	397.8227	274.3651	194.7984 (83)
Total gains	892.1937	986.9936	1088.1711	1170.1616	1175.9867	1208.5463	1135.6408	1102.1754	1046.6129	960.8561	882.7108	837.7096 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	13.7685	13.8750	13.9093	14.0088	14.0088	14.0407	14.0407	14.0720	14.0720	13.9762	13.9762	13.9431
alpha	1.9179	1.9250	1.9273	1.9339	1.9339	1.9360	1.9360	1.9381	1.9381	1.9317	1.9317	1.9295
util living area	0.8878	0.8646	0.8194	0.7470	0.6444	0.4848	0.3656	0.3648	0.5594	0.7392	0.8463	0.8961 (86)
MIT	18.2837	18.5317	19.0520	19.6945	20.2931	20.7327	20.8966	20.9005	20.6253	19.9779	19.0879	18.2651 (87)
Th 2	19.8453	19.8531	19.8555	19.8627	19.8627	19.8650	19.8650	19.8672	19.8672	19.8604	19.8604	19.8580 (88)
util rest of house	0.8743	0.8487	0.7975	0.7141	0.5917	0.4025	0.2547	0.2506	0.4804	0.6963	0.8247	0.8833 (89)
MIT 2	16.3564	16.7053	17.4337	18.3218	19.1203	19.6514	19.8141	19.8203	19.5432	18.7228	17.4999	16.3357 (90)
Living area fraction									fLA =	Living area / (4) =		0.1892 (91)
MIT	16.7209	17.0508	17.7398	18.5815	19.3422	19.8559	20.0189	20.0246	19.7479	18.9602	17.8003	16.7007 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.5709	16.9008	17.5898	18.4315	19.1922	19.7059	19.8689	19.8746	19.5979	18.8102	17.6503	16.5507 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8199	0.7926	0.7411	0.6636	0.5557	0.3898	0.2551	0.2514	0.4591	0.6478	0.7682	0.8304 (94)
Useful gains	731.5278	782.2592	806.4463	776.5735	653.4588	471.1477	289.7397	277.0484	480.4829	622.4159	678.0952	695.6269 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1574.8167	1552.6489	1418.1751	1186.2374	867.4013	540.6509	308.1013	294.0520	580.8399	929.0820	1263.0390	1537.8929 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	627.4069	517.7019	455.1262	294.9580	159.1732	0.0000	0.0000	0.0000	0.0000	228.1596	421.1596	626.6459 (98)
Space heating												3330.3313 (98)
RHI space heating demand												3330 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1791 (8)
Pressure test					Yes
Measured/design AP50					3.7800
Infiltration rate					0.3681 (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) =	0.3681 (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	0.4693	0.4601	0.4509	0.4049	0.3957	0.3497	0.3497	0.3405	0.3681	0.3957	0.4141	0.4325 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5820	0.5783	0.5611	0.5611	0.5580	0.5677	0.5783	0.5857	0.5935 (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			1.9000	1.2000	2.2800		(26)
Half Glazed Door			2.0900	1.4000	2.9260		(26a)
Windows (Uw = 1.40)			17.4200	1.3258	23.0947		(27)
Flr - Ground			55.9640	0.1800	10.0735	75.6000	4230.8784 (28a)
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.2100	27.2391	7.4000	959.8540 (29a)
Rf - Ins Joist	55.9640		55.9640	0.0800	4.4771	7.4000	414.1336 (30)
Total net area of external elements Aum(A, m ²)			263.0480				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0904		(33)
Stud			100.9904			7.4000	747.3293 (32c)
Internal Floor			55.9640			7.4000	414.1336 (32d)
Internal Ceiling			55.9640			7.4000	414.1336 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7180.4625 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.1571 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3336 (36)
Total fabric heat loss							(33) + (36) = 89.4240 (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	56.2211	55.8271	55.4409	53.6269	53.2876	51.7077	51.7077	51.4151	52.3162	53.2876	53.9741	54.6919 (38)
Heat transfer coeff	145.6451	145.2511	144.8649	143.0510	142.7116	141.1317	141.1317	140.8391	141.7403	142.7116	143.3982	144.1159 (39)
Average = Sum(39)m / 12 =												143.0494 (39)
HLP	1.3013	1.2978	1.2944	1.2782	1.2751	1.2610	1.2610	1.2584	1.2664	1.2751	1.2813	1.2877 (40)
HLP (average)												1.2781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.4459	107.3933	103.3408	99.2882	95.2356	91.1830	91.1830	95.2356	99.2882	103.3408	107.3933	111.4459 (44)
Energy conte	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Energy content (annual)										Total = Sum(45)m =		1594.0712 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	24.7907	21.6821	22.3740	19.5062	18.7166	16.1510	14.9663	17.1740	17.3792	20.2537	22.1085	24.0084 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6694	0.6089	0.6525	0.5810	0.5347	0.4418	0.4094	0.4907	0.5177	0.5906	0.6208	0.6483 (61)
Total heat required for water heating calculated for each month												
WWHRS	165.9405	145.1560	149.8122	130.6221	125.3122	108.1153	100.1847	114.9843	116.3787	135.6155	148.0111	160.7045 (62)
	-55.0538	-48.4415	-49.4402	-40.6697	-37.7584	-31.1459	-26.3543	-31.9108	-32.8442	-40.6077	-47.0466	-53.2138 eq. (G10)
Total of WWHRS savings												-494.4869
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 (63)
								Solar input	(sum of months)	=	Sum (63)m =	0.0000 (63)
Output from w/h	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
								Total per year (kWh/year)	=	Sum (64)m =		1106.3501 (64)
Heat gains from water heating, kWh/month												
	55.1200	48.2141	49.7587	43.3839	41.6222	35.9119	33.2776	38.1918	38.6532	45.0434	49.1625	53.3808 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7726	56.6423	46.0646	34.8738	26.0686	22.0082	23.7807	30.9110	41.4887	52.6794	61.4846	65.5450 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.3823	413.6304	402.9253	380.1355	351.3673	324.3293	306.2663	302.0182	312.7233	335.5132	364.2813	391.3193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349 (71)
Water heating gains (Table 5)	74.0860	71.7472	66.8800	60.2554	55.9438	49.8776	44.7280	51.3331	53.6850	60.5422	68.2812	71.7483 (72)
Total internal gains	661.5395	656.3185	630.1685	589.5633	547.6783	510.5137	489.0735	498.5608	522.1956	563.0334	608.3457	642.9112 (73)

[Jan]					Area	Solar flux		g	FF	Access		Gains
					m2	Table 6a	W/m2	Specific data	Specific data	factor	W	
								or Table 6b	or Table 6c	Table 6d		
North					8.1710	10.6334		0.7300	0.7200			31.6472 (74)
South					9.2460	46.7521		0.7300	0.7200	0.7700	0.7700	157.4502 (78)
Solar gains	189.0974	318.3424	431.2410	536.3182	609.2292	610.3530	586.0126	529.5903	466.6895	350.1222	225.6731	162.4342 (84)
Total gains	850.6369	974.6608	1061.4095	1125.8815	1156.9075	1120.8668	1075.0862	1028.1512	988.8850	913.1556	834.0188	805.3454 (83)

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	13.6947	13.7319	13.7685	13.9431	13.9762	14.1327	14.1327	14.1621	14.0720	13.9762	13.9093	13.8401
alpha	1.9130	1.9155	1.9179	1.9295	1.9317	1.9422	1.9422	1.9441	1.9381	1.9317	1.9273	1.9227
util living area	0.9086	0.8817	0.8453	0.7872	0.7031	0.5870	0.4727	0.5024	0.6560	0.8017	0.8823	0.9162 (86)
MIT	17.8452	18.1834	18.7052	19.3775	20.0116	20.5252	20.7817	20.7454	20.3641	19.5533	18.5881	17.7803 (87)
Th 2	19.8398	19.8425	19.8453	19.8580	19.8604	19.8715	19.8715	19.8736	19.8672	19.8604	19.8555	19.8505 (88)
util rest of house	0.8981	0.8684	0.8272	0.7603	0.6611	0.5200	0.3777	0.4095	0.5954	0.7713	0.8669	0.9066 (89)
MIT 2	15.7322	16.2088	16.9441	17.8862	18.7509	19.4213	19.7160	19.6828	19.2297	18.1473	16.7949	15.6433 (90)
Living area fraction									fLA = Living area / (4) =			0.1892 (91)
MIT	16.1319	16.5823	17.2772	18.1683	18.9893	19.6301	19.9176	19.8838	19.4443	18.4133	17.1341	16.0476 (92)
Temperature adjustment												-0.1500
adjusted MIT	15.9819	16.4323	17.1272	18.0183	18.8393	19.4801	19.7676	19.7338	19.2943	18.2633	16.9841	15.8976 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8469	0.8133	0.7701	0.7058	0.6163	0.4936	0.3680	0.3966	0.5593	0.7164	0.8121	0.8573 (94)
Useful gains	720.4194	792.6926	817.4370	794.6991	713.0390	553.2956	395.6509	407.8025	553.0749	654.1537	677.3105	690.4472 (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	1701.4065	1675.0800	1539.5136	1304.3802	1018.8656	688.7341	447.0438	469.5280	736.2431	1093.6376	1417.3649	1685.8046 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	729.8544	592.9643	537.2249	366.9704	227.5350	0.0000	0.0000	0.0000	0.0000	326.9760	532.8391	740.5459 (98)
Space heating												4054.9101 (98)
Space heating per m2												36.2304 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4495.4658 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	729.8544	592.9643	537.2249	366.9704	227.5350	0.0000	0.0000	0.0000	0.0000	326.9760	532.8391	740.5459 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	809.1512	657.3884	595.5931	406.8408	252.2561	0.0000	0.0000	0.0000	0.0000	362.5012	590.7308	821.0043 (211)
Water heating 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 (215)
Water heating requirement	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
Efficiency of water heater (217)m	88.1011	87.9717	87.7061	87.1027	85.8891	76.4000	76.4000	76.4000	76.4000	86.6751	87.6772	76.4000 (216)
Fuel for water heating, kWh/month	125.8629	109.9382	114.4414	103.2716	101.9382	100.7453	96.6366	108.7349	109.3383	109.6137	115.1548	121.8977 (219)
Water heating fuel used												1317.5736 (219)
Annual totals kWh/year												
Space heating fuel - main system												4495.4658 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												450.4976 (232)
Total delivered energy for all uses												6338.5369 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4495.4658	3.4800	156.4422 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1317.5736	3.4800	45.8516 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	450.4976	13.1900	59.4206 (250)
Additional standing charges			120.0000 (251)
Total energy cost			391.6069 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0481 (257)
SAP value		85.3784
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	4495.4658	0.2160	971.0206 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1317.5736	0.2160	284.5959 (264)
Space and water heating			1255.6165 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.4976	0.5190	233.8082 (268)
Total kg/year			1528.3497 (272)
CO2 emissions per m2			13.6600 (273)
EI value			86.9488
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8374 = 4.156$, stars = 5
Water heating environmental impact	$0.216 / 0.8374 = 0.2579$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1791 (8)
Pressure test					Yes
Measured/design AP50					3.7800
Infiltration rate					0.3681 (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) =	0.3681 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4509	0.4233	0.4141	0.3865	0.3865	0.3773	0.3773	0.3681	0.3681	0.3957	0.3957	0.4049 (22b)
Effective ac	0.6016	0.5896	0.5857	0.5747	0.5747	0.5712	0.5712	0.5677	0.5677	0.5783	0.5783	0.5820 (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			1.9000	1.2000	2.2800		(26)
Half Glazed Door			2.0900	1.4000	2.9260		(26a)
Windows (Uw = 1.40)			17.4200	1.3258	23.0947		(27)
Flr - Ground			55.9640	0.1800	10.0735	75.6000	4230.8784 (28a)
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.2100	27.2391	7.4000	959.8540 (29a)
Rf - Ins Joist	55.9640		55.9640	0.0800	4.4771	7.4000	414.1336 (30)
Total net area of external elements Aum(A, m ²)			263.0480				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0904		(33)
Stud			100.9904			7.4000	747.3293 (32c)
Internal Floor			55.9640			7.4000	414.1336 (32d)
Internal Ceiling			55.9640			7.4000	414.1336 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7180.4625 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.1571 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3336 (36)
Total fabric heat loss							(33) + (36) = 89.4240 (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	55.4409	54.3291	53.9741	52.9560	52.9560	52.6322	52.6322	52.3162	52.3162	53.2876	53.2876	53.6269 (38)
Heat transfer coeff	144.8649	143.7532	143.3982	142.3800	142.3800	142.0562	142.0562	141.7403	141.7403	142.7116	142.7116	143.0510 (39)
Average = Sum(39)m / 12 =												142.7370 (39)
HLP	1.2944	1.2844	1.2813	1.2722	1.2722	1.2693	1.2693	1.2664	1.2664	1.2751	1.2751	1.2782 (40)
HLP (average)												1.2753 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.4459	107.3933	103.3408	99.2882	95.2356	91.1830	91.1830	95.2356	99.2882	103.3408	107.3933	111.4459 (44)
Energy conte	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Energy content (annual)										Total = Sum(45)m =		1594.0712 (45)
Distribution loss (46)m = 0.15 x (45)m												

[illegible]

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7726	56.6423	46.0646	34.8738	26.0686	22.0082	23.7807	30.9110	41.4887	52.6794	61.4846	65.5450 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.3823	413.6304	402.9253	380.1355	351.3673	324.3293	306.2663	302.0182	312.7233	335.5132	364.2813	391.3193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349 (71)
Water heating gains (Table 5)	74.0860	71.7472	66.8800	60.2554	55.9438	49.8776	44.7280	51.3331	53.6850	60.5422	68.2812	71.7483 (72)
Total internal gains	661.5395	656.3185	630.1685	589.5633	547.6783	510.5137	489.0735	498.5608	522.1956	563.0334	608.3457	642.9112 (73)

[Jan					Area	Solar flux	g		FF	Access		Gains
					m2	Table 6a	Specific data		Specific data	factor		W
						W/m2	or Table 6b		or Table 6c	Table 6d		
North					8.1710	13.4684	0.7300		0.7200	0.7700		40.0849 (74)
South					9.2460	56.5862	0.7300		0.7200	0.7700		190.5694 (78)

Solar gains	230.6542	330.6751	458.0026	580.5983	628.3084	698.0325	646.5672	603.6145	524.4174	397.8227	274.3651	194.7984 (83)
Total gains	892.1937	986.9936	1088.1711	1170.1616	1175.9867	1208.5463	1135.6408	1102.1754	1046.6129	960.8561	882.7108	837.7096 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.7685	13.8750	13.9093	14.0088	14.0088	14.0407	14.0407	14.0720	14.0720	13.9762	13.9762	13.9431
alpha	1.9179	1.9250	1.9273	1.9339	1.9339	1.9360	1.9360	1.9381	1.9381	1.9317	1.9317	1.9295
util living area	0.8878	0.8646	0.8194	0.7470	0.6444	0.4848	0.3656	0.3648	0.5594	0.7392	0.8463	0.8961 (86)
MIT	18.2837	18.5317	19.0520	19.6945	20.2931	20.7327	20.8966	20.9005	20.6253	19.9779	19.0879	18.2651 (87)
Th 2	19.8453	19.8531	19.8555	19.8627	19.8627	19.8650	19.8650	19.8672	19.8672	19.8604	19.8604	19.8580 (88)
util rest of house	0.8743	0.8487	0.7975	0.7141	0.5917	0.4025	0.2547	0.2506	0.4804	0.6963	0.8247	0.8833 (89)
MIT 2	16.3564	16.7053	17.4337	18.3218	19.1203	19.6514	19.8141	19.8203	19.5432	18.7228	17.4999	16.3357 (90)
Living area fraction	16.7209	17.0508	17.7398	18.5815	19.3422	19.8559	20.0189	20.0246	19.7479	18.9602	17.8003	0.1892 (91)
MIT	16.7209	17.0508	17.7398	18.5815	19.3422	19.8559	20.0189	20.0246	19.7479	18.9602	17.8003	16.7007 (92)
Temperature adjustment	16.5709	16.9008	17.5898	18.4315	19.1922	19.7059	19.8689	19.8746	19.5979	18.8102	17.6503	-0.1500
adjusted MIT	16.5709	16.9008	17.5898	18.4315	19.1922	19.7059	19.8689	19.8746	19.5979	18.8102	17.6503	16.5507 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8199	0.7926	0.7411	0.6636	0.5557	0.3898	0.2551	0.2514	0.4591	0.6478	0.7682	0.8304	(94)
Useful gains	731.5278	782.2592	806.4463	776.5735	653.4588	471.1477	289.7397	277.0484	480.4829	622.4159	678.0952	695.6269	(95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000	(96)
Heat loss rate W													
	1574.8167	1552.6489	1418.1751	1186.2374	867.4013	540.6509	308.1013	294.0520	580.8399	929.0820	1263.0390	1537.8929	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	627.4069	517.7019	455.1262	294.9580	159.1732	0.0000	0.0000	0.0000	0.0000	228.1596	421.1596	626.6459	(98)
Space heating													3330.3313 (98)
Space heating per m2													29.7564 (99)
										(98) / (4) =			

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3692.1633 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	627.4069	517.7019	455.1262	294.9580	159.1732	0.0000	0.0000	0.0000	0.0000	228.1596	421.1596	626.6459 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	695.5731	573.9489	504.5745	327.0045	176.4670	0.0000	0.0000	0.0000	0.0000	252.9485	466.9175	694.7294 (211)
Water heating 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 (215)
Water heating requirement	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
Efficiency of water heater (217)m	87.8176	87.7063	87.3491	86.5467	84.7666	76.4000	76.4000	76.4000	76.4000	85.6517	87.1558	76.4000 (216)
Fuel for water heating, kWh/month	126.2693	110.2709	114.9090	103.9351	103.2880	100.7453	96.6366	108.7349	109.3383	110.9234	115.8437	122.3210 (219)
Water heating fuel used												1323.2156 (219)
Annual totals kWh/year												
Space heating fuel - main system												3692.1633 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												450.4976 (232)
Total delivered energy for all uses												5540.8766 (238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3692.1633	5.7300	211.5610 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1323.2156	5.7300	75.8203 (247)
Pumps and fans for heating	75.0000	24.1800	18.1350 (249)
Energy for lighting	450.4976	24.1800	108.9303 (250)
Additional standing charges			114.0000 (251)
Total energy cost			528.4465 (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	3692.1633	0.2160	797.5073 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1323.2156	0.2160	285.8146 (264)
Space and water heating			1083.3219 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.4976	0.5190	233.8082 (268)
Total kg/year			1356.0551 (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	3692.1633	1.2200	4504.4393 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1323.2156	1.2200	1614.3231 (264)
Space and water heating			6118.7623 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	450.4976	3.0700	1383.0276 (268)
Primary energy kWh/year			7732.0399 (272)
Primary energy kWh/m2/year			69.0854 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Recommended
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 8.5	-£ 471	-1010 kg (74.5%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 35	-151 kg (11.1%)
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Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£471 9.03 kg/m²	A 94	A 95
Total Savings	£471 9.03 kg/m²		
Potential energy efficiency rating:		A 94	
Potential environmental impact rating:			A 95

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£127	£127	£0
Mains gas	£401	£401	£0
Space heating	£344	£344	£0
Water heating	£76	£76	£0
Lighting	£109	£109	£0
Generated (PV)	-£0	-£471	£471
Total cost of fuels	£528	£57	£471
Total cost of uses	£529	£58	£471
Delivered energy	50 kWh/m²	32 kWh/m²	17 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.0 tonnes
CO2 emissions per m²	12 kg/m²	3 kg/m²	9 kg/m²
Primary energy	69 kWh/m²	16 kWh/m²	53 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (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)+(7a)+(7b)+(7c) =				50.0000	/ (5) =	0.1791 (8)	
Pressure test										Yes							
Measured/design AP50										3.7800							
Infiltration rate										0.3681 (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) =				0.3681 (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	0.4693	0.4601	0.4509	0.4049	0.3957	0.3497	0.3497	0.3405	0.3681	0.3957	0.4141	0.4325	(22b)				
Effective ac	0.6101	0.6058	0.6016	0.5820	0.5783	0.5611	0.5611	0.5580	0.5677	0.5783	0.5857	0.5935	(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			1.9000	1.2000	2.2800		(26)					
Half Glazed Door			2.0900	1.4000	2.9260		(26a)					
Windows (Uw = 1.40)			17.4200	1.3258	23.0947		(27)					
Flr - Ground			55.9640	0.1800	10.0735	75.6000	4230.8784 (28a)					
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.2100	27.2391	7.4000	959.8540 (29a)					
Rf - Ins Joist	55.9640		55.9640	0.0800	4.4771	7.4000	414.1336 (30)					
Total net area of external elements Aum(A, m2)			263.0480				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0904		(33)					
Stud			100.9904			7.4000	747.3293 (32c)					
Internal Floor			55.9640			7.4000	414.1336 (32d)					
Internal Ceiling			55.9640			7.4000	414.1336 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7180.4625 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							64.1571 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3336 (36)					
Total fabric heat loss						(33) + (36) =	89.4240 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.2211	Feb 55.8271	Mar 55.4409	Apr 53.6269	May 53.2876	Jun 51.7077	Jul 51.7077	Aug 51.4151	Sep 52.3162	Oct 53.2876	Nov 53.9741	Dec 54.6919 (38)
Heat transfer coeff	145.6451	145.2511	144.8649	143.0510	142.7116	141.1317	141.1317	140.8391	141.7403	142.7116	143.3982	144.1159 (39)
Average = Sum(39)m / 12 =												143.0494 (39)
HLP	Jan 1.3013	Feb 1.2978	Mar 1.2944	Apr 1.2782	May 1.2751	Jun 1.2610	Jul 1.2610	Aug 1.2584	Sep 1.2664	Oct 1.2751	Nov 1.2813	Dec 1.2877 (40)
HLP (average)												1.2781 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)
Daily hot water use	Jan 111.4459	Feb 107.3933	Mar 103.3408	Apr 99.2882	May 95.2356	Jun 91.1830	Jul 91.1830	Aug 95.2356	Sep 99.2882	Oct 103.3408	Nov 107.3933	Dec 111.4459 (44)
Energy conte	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Energy content (annual)												Total = Sum(45)m = 1594.0712 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	24.7907	21.6821	22.3740	19.5062	18.7166	16.1510	14.9663	17.1740	17.3792	20.2537	22.1085	24.0084 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6694	0.6089	0.6525	0.5810	0.5347	0.4418	0.4094	0.4907	0.5177	0.5906	0.6208	0.6483 (61)
Total heat required for water heating calculated for each month												
	165.9405	145.1560	149.8122	130.6221	125.3122	108.1153	100.1847	114.9843	116.3787	135.6155	148.0111	160.7045 (62)
WWHRS	-55.0538	-48.4415	-49.4402	-40.6697	-37.7584	-31.1459	-26.3543	-31.9108	-32.8442	-40.6077	-47.0466	-53.2138 eq. (G10)
Total of WWHRS savings												-494.4869
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 (63)
								Solar input	(sum of months)	=	Sum(63)m =	0.0000 (63)
Output from w/h	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
								Total per year (kWh/year)	=	Sum(64)m =		1106.3501 (64)
Heat gains from water heating, kWh/month												
	55.1200	48.2141	49.7587	43.3839	41.6222	35.9119	33.2776	38.1918	38.6532	45.0434	49.1625	53.3808 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Not applicable

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 %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4495.4658	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.8544	592.9643	537.2249	366.9704	227.5350	0.0000	0.0000	0.0000	0.0000	326.9760	532.8391	740.5459	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	809.1512	657.3884	595.5931	406.8408	252.2561	0.0000	0.0000	0.0000	0.0000	362.5012	590.7308	821.0043	(211)
Water heating 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	(215)
Water heating requirement	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907	(64)
Efficiency of water heater (217)m	88.1011	87.9717	87.7061	87.1027	85.8891	76.4000	76.4000	76.4000	76.4000	86.6751	87.6772	88.1811	(216)
Fuel for water heating, kWh/month	125.8629	109.9382	114.4414	103.2716	101.9382	100.7453	96.6366	108.7349	109.3383	109.6137	115.1548	121.8977	(219)
Water heating fuel used												1317.5736	(219)
Annual totals kWh/year													
Space heating fuel - main system												4495.4658	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												450.4976	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												4611.2975	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4495.4658	3.4800	156.4422 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1317.5736	3.4800	45.8516 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	450.4976	13.1900	59.4206 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			163.7840 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4384 (257)
SAP value	93.8847	
SAP rating (Section 12)	94	(258)
SAP band	A	

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	4495.4658	0.2160	971.0206	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1317.5736	0.2160	284.5959	(264)
Space and water heating			1255.6165	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	450.4976	0.5190	233.8082	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			631.9125	(272)
CO2 emissions per m2			5.6500	(273)
EI value			94.6039	
EI rating			95	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9600 (1b)	x 2.3700 (2b)	= 132.6252 (1b) - (3b)
First floor	55.9600 (1c)	x 2.6200 (2c)	= 146.6152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.2404 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1791 (8)
Pressure test					Yes
Measured/design AP50					3.7800
Infiltration rate					0.3681 (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) =	0.3681 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4509	0.4233	0.4141	0.3865	0.3865	0.3773	0.3773	0.3681	0.3681	0.3957	0.3957	0.4049 (22b)
Effective ac	0.6016	0.5896	0.5857	0.5747	0.5747	0.5712	0.5712	0.5677	0.5677	0.5783	0.5783	0.5820 (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			1.9000	1.2000	2.2800		(26)
Half Glazed Door			2.0900	1.4000	2.9260		(26a)
Windows (Uw = 1.40)			17.4200	1.3258	23.0947		(27)
Flr - Ground			55.9640	0.1800	10.0735	75.6000	4230.8784 (28a)
Wl - Brick (Timber Frame)	151.1190	21.4090	129.7100	0.2100	27.2391	7.4000	959.8540 (29a)
Rf - Ins Joist	55.9640		55.9640	0.0800	4.4771	7.4000	414.1336 (30)
Total net area of external elements Aum(A, m ²)			263.0480				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0904		(33)
Stud			100.9904			7.4000	747.3293 (32c)
Internal Floor			55.9640			7.4000	414.1336 (32d)
Internal Ceiling			55.9640			7.4000	414.1336 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7180.4625 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.1571 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.3336 (36)
Total fabric heat loss							(33) + (36) = 89.4240 (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	55.4409	54.3291	53.9741	52.9560	52.9560	52.6322	52.6322	52.3162	52.3162	53.2876	53.2876	53.6269 (38)
Heat transfer coeff	144.8649	143.7532	143.3982	142.3800	142.3800	142.0562	142.0562	141.7403	141.7403	142.7116	142.7116	143.0510 (39)
Average = Sum(39)m / 12 =												142.7370 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2944	1.2844	1.2813	1.2722	1.2722	1.2693	1.2693	1.2664	1.2664	1.2751	1.2751	1.2782 (40)
HLP (average)												1.2753 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8259 (42)
Average daily hot water use (litres/day)												101.3145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4459	107.3933	103.3408	99.2882	95.2356	91.1830	91.1830	95.2356	99.2882	103.3408	107.3933	111.4459 (44)
Energy conte	165.2711	144.5471	149.1597	130.0410	124.7775	107.6735	99.7753	114.4936	115.8610	135.0249	147.3902	160.0562 (45)
Energy content (annual)										Total = Sum(45)m =		1594.0712 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	24.7907	21.6821	22.3740	19.5062	18.7166	16.1510	14.9663	17.1740	17.3792	20.2537	22.1085	24.0084 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6694	0.6089	0.6525	0.5810	0.5347	0.4418	0.4094	0.4907	0.5177	0.5906	0.6208	0.6483 (61)
Total heat required for water heating calculated for each month												
WWHRS	165.9405	145.1560	149.8122	130.6221	125.3122	108.1153	100.1847	114.9843	116.3787	135.6155	148.0111	160.7045 (62)
	-55.0538	-48.4415	-49.4402	-40.6697	-37.7584	-31.1459	-26.3543	-31.9108	-32.8442	-40.6077	-47.0466	-53.2138 eq. (G10)
Total of WWHRS savings												-494.4869
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 (63)
								Solar input	(sum of months) =	Sum (63)m =		0.0000 (63)
Output from w/h	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907 (64)
								Total per year (kWh/year) =	Sum (64)m =			1106.3501 (64)
Heat gains from water heating, kWh/month												
	55.1200	48.2141	49.7587	43.3839	41.6222	35.9119	33.2776	38.1918	38.6532	45.0434	49.1625	53.3808 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524	169.5524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.7726	56.6423	46.0646	34.8738	26.0686	22.0082	23.7807	30.9110	41.4887	52.6794	61.4846	65.5450 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.3823	413.6304	402.9253	380.1355	351.3673	324.3293	306.2663	302.0182	312.7233	335.5132	364.2813	391.3193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811	54.7811 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349	-113.0349 (71)
Water heating gains (Table 5)	74.0860	71.7472	66.8800	60.2554	55.9438	49.8776	44.7280	51.3331	53.6850	60.5422	68.2812	71.7483 (72)
Total internal gains	661.5395	656.3185	630.1685	589.5633	547.6783	510.5137	489.0735	498.5608	522.1956	563.0334	608.3457	642.9112 (73)

[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				8.1710	13.4684	0.7300	0.7200	0.7700	40.0849 (74)			
South				9.2460	56.5862	0.7300	0.7200	0.7700	190.5694 (78)			
Solar gains	230.6542	330.6751	458.0026	580.5983	628.3084	698.0325	646.5672	603.6145	524.4174	397.8227	274.3651	194.7984 (83)
Total gains	892.1937	986.9936	1088.1711	1170.1616	1175.9867	1208.5463	1135.6408	1102.1754	1046.6129	960.8561	882.7108	837.7096 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.7685	13.8750	13.9093	14.0088	14.0088	14.0407	14.0407	14.0720	14.0720	13.9762	13.9762	13.9431
alpha	1.9179	1.9250	1.9273	1.9339	1.9339	1.9360	1.9360	1.9381	1.9381	1.9317	1.9317	1.9295
util living area												
	0.8878	0.8646	0.8194	0.7470	0.6444	0.4848	0.3656	0.3648	0.5594	0.7392	0.8463	0.8961 (86)
MIT	18.2837	18.5317	19.0520	19.6945	20.2931	20.7327	20.8966	20.9005	20.6253	19.9779	19.0879	18.2651 (87)
Th 2	19.8453	19.8531	19.8555	19.8627	19.8627	19.8650	19.8650	19.8672	19.8672	19.8604	19.8604	19.8580 (88)
util rest of house												
	0.8743	0.8487	0.7975	0.7141	0.5917	0.4025	0.2547	0.2506	0.4804	0.6963	0.8247	0.8833 (89)
MIT 2	16.3564	16.7053	17.4337	18.3218	19.1203	19.6514	19.8141	19.8203	19.5432	18.7228	17.4999	16.3357 (90)
Living area fraction												
									fLA = Living area / (4) =	0.1892	0.1892	0.1892 (91)
MIT	16.7209	17.0508	17.7398	18.5815	19.3422	19.8559	20.0189	20.0246	19.7479	18.9602	17.8003	16.7007 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.5709	16.9008	17.5898	18.4315	19.1922	19.7059	19.8689	19.8746	19.5979	18.8102	17.6503	16.5507 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8199	0.7926	0.7411	0.6636	0.5557	0.3898	0.2551	0.2514	0.4591	0.6478	0.7682	0.8304 (94)
Useful gains	731.5278	782.2592	806.4463	776.5735	653.4588	471.1477	289.7397	277.0484	480.4829	622.4159	678.0952	695.6269 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1574.8167	1552.6489	1418.1751	1186.2374	867.4013	540.6509	308.1013	294.0520	580.8399	929.0820	1263.0390	1537.8929 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	627.4069	517.7019	455.1262	294.9580	159.1732	0.0000	0.0000	0.0000	0.0000	228.1596	421.1596	626.6459 (98)
Space heating												3330.3313 (99)
Space heating per m2												29.7564 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Not applicable

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 %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3692.1633	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	627.4069	517.7019	455.1262	294.9580	159.1732	0.0000	0.0000	0.0000	0.0000	228.1596	421.1596	626.6459	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	695.5731	573.9489	504.5745	327.0045	176.4670	0.0000	0.0000	0.0000	0.0000	252.9485	466.9175	694.7294	(211)
Water heating 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	(215)
Water heating													
Water heating requirement	110.8867	96.7145	100.3720	89.9523	87.5538	76.9694	73.8304	83.0735	83.5345	95.0078	100.9645	107.4907	(64)
Efficiency of water heater (217)m	87.8176	87.7063	87.3491	86.5467	84.7666	76.4000	76.4000	76.4000	76.4000	85.6517	87.1558	76.4000	(216)
Fuel for water heating, kWh/month	126.2693	110.2709	114.9090	103.9351	103.2880	100.7453	96.6366	108.7349	109.3383	110.9234	115.8437	122.3210	(219)
Water heating fuel used												1323.2156	(219)
Annual totals kWh/year													
Space heating fuel - main system												3692.1633	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												450.4976	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1217 * 0.80) =										-1946.4459		-1946.4459	(233)
Total delivered energy for all uses												3594.4306	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3692.1633	5.7300	211.5610	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1323.2156	5.7300	75.8203	(247)
Pumps and fans for heating	75.0000	24.1800	18.1350	(249)
Energy for lighting	450.4976	24.1800	108.9303	(250)
Additional standing charges			114.0000	(251)
Energy saving/generation technologies				
PV Unit	-1946.4459	24.1800	-470.6506	(252)
Total energy cost			57.7959	(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	3692.1633	0.2160	797.5073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1323.2156	0.2160	285.8146	(264)
Space and water heating			1083.3219	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	450.4976	0.5190	233.8082	(268)
Energy saving/generation technologies				
PV Unit	-1946.4459	0.5190	-1010.2054	(269)
Total kg/year			345.8497	(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	3692.1633	1.2200	4504.4393	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1323.2156	1.2200	1614.3231	(264)
Space and water heating			6118.7623	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	450.4976	3.0700	1383.0276	(268)
Energy saving/generation technologies				
PV Unit	-1946.4459	3.0700	-5975.5890	(269)
Primary energy kWh/year			1756.4509	(272)
Primary energy kWh/m2/year			15.6938	(273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	069 - PRJ013014			Issued on Date	14/04/2025
Assessment Reference	069		Prop Type Ref	B	
Property	3 Caveney View, Netley Abbey, SOUTHAMPTON, SO31 5JR				
SAP Rating	85 B	DER	14.52	TER	17.64
Environmental	87 B	% DER<TER	17.69		
CO ₂ Emissions (t/year)	1.36	DFEE	48.14	TFEE	56.49
General Requirements Compliance	Pass	% DFEE<TFEE	14.78		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.64	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.52	kgCO ₂ /m ²	Pass
	-3.12 (-17.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.49	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.14	kWh/m ² /yr	
	-8.4 (-14.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.78 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB) Combi boiler Efficiency: 89.3% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.17 m², No overhang

Windows facing South

9.25 m², No overhang

Air change rate

4.70 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

3.78 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.08

W/m²K

Air permeability

3.8

m³/m²h

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.