

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	022 - PRJ013014			Issued on Date	08/02/2024
Assessment Reference	022	Prop Type Ref	D		
Property	6 Deeble way, Netley Abbey, Southampton, SO31 5JP				
SAP Rating	85 B	DER	15.66	TER	18.83
Environmental	86 B	% DER<TER	16.85		
CO ₂ Emissions (t/year)	1.26	DFEE	52.62	TFEE	59.95
General Requirements Compliance	Pass	% DFEE<TFEE	12.23		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	U903-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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DWELLING AS BUILT

Detached House, total floor area 96 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) 18.83 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.66 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 59.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 52.6 kWh/m²/yr OK

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: 4.57 (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 East: 7.22 m², No overhang

Windows facing South East: 5.25 m², No overhang

Windows facing South West: 0.72 m², No overhang

Windows facing North West: 7.17 m², No overhang

Air change rate: 4.69 ach

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

10 Key features

Roof U-value 0.08 W/m²K

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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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1665 (8)	
Pressure test															Yes		
Measured/design AP50																4.5700	
Infiltration rate																0.3950 (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) =						0.3950 (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	0.5036	0.4937	0.4839	0.4345	0.4246	0.3752	0.3752	0.3654	0.3950	0.4246	0.4444	0.4641	(22b)				
Effective ac	0.6268	0.6219	0.6171	0.5944	0.5901	0.5704	0.5704	0.5667	0.5780	0.5901	0.5987	0.6077	(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			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.8403		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.8319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)
Total fabric heat loss							(33) + (36) = 86.5106 (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	49.6986	49.3082	48.9255	47.1280	46.7917	45.2262	45.2262	44.9362	45.8292	46.7917	47.4721	48.1833 (38)
Heat transfer coeff	136.2092	135.8188	135.4361	133.6386	133.3023	131.7368	131.7368	131.4469	132.3398	133.3023	133.9827	134.6939 (39)
Average = Sum(39)m / 12 =												133.6370 (39)
HLP	1.4144	1.4104	1.4064	1.3877	1.3842	1.3680	1.3680	1.3650	1.3742	1.3842	1.3913	1.3987 (40)
HLP (average)												1.3877 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	Jan 108.2237	Feb 104.2883	Mar 100.3528	Apr 96.4174	May 92.4820	Jun 88.5466	Jul 88.5466	Aug 92.4820	Sep 96.4174	Oct 100.3528	Nov 104.2883	Dec 108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9814 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3234	19.8274	16.1248	12.2075	9.1252	7.7039	8.3243	10.8203	14.5230	18.4403	21.5225	22.9438 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127 (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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013 (71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806 (72)
Total internal gains	411.0160	408.8447	393.8722	369.5818	344.7309	320.8946	305.4752	311.7881	324.3170	348.8321	377.0128	398.3264 (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			
Northeast				7.2210	11.2829	0.7300		0.7200	0.7700		29.6762 (75)	
Southeast				5.2480	36.7938	0.7300		0.7200	0.7700		70.3327 (77)	
Southwest				0.7190	36.7938	0.7300		0.7200	0.7700		9.6359 (79)	
Northwest				7.1650	11.2829	0.7300		0.7200	0.7700		29.4461 (81)	

Solar gains	139.0909	256.5612	403.2004	587.0165	737.3110	767.0820	724.9407	607.4477	466.0096	297.6191	170.1751	116.7187 (83)
Total gains	550.1068	665.4060	797.0726	956.5983	1082.0419	1087.9767	1030.4159	919.2358	790.3266	646.4512	547.1878	515.0451 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
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	12.5359	12.5719	12.6074	12.7770	12.8092	12.9615	12.9615	12.9901	12.9024	12.8092	12.7442	12.6769
alpha	1.8357	1.8381	1.8405	1.8518	1.8539	1.8641	1.8641	1.8660	1.8602	1.8539	1.8496	1.8451
util living area	0.9430	0.9191	0.8775	0.8010	0.6928	0.5657	0.4583	0.5104	0.6962	0.8537	0.9244	0.9489 (86)
MIT	17.3012	17.6763	18.3273	19.1867	19.9540	20.5106	20.7690	20.7084	20.2220	19.2189	18.1135	17.2371 (87)
Th 2	19.7523	19.7554	19.7584	19.7728	19.7754	19.7880	19.7880	19.7903	19.7831	19.7754	19.7700	19.7643 (88)
util rest of house	0.9357	0.9089	0.8615	0.7738	0.6479	0.4948	0.3585	0.4108	0.6341	0.8275	0.9131	0.9424 (89)
MIT 2	14.9535	15.4829	16.3984	17.5934	18.6258	19.3399	19.6319	19.5801	19.0109	17.6679	16.1139	14.8649 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.1967 (91)
MIT	15.4153	15.9143	16.7778	17.9068	18.8870	19.5702	19.8555	19.8020	19.2491	17.9729	16.5072	15.3315 (92)
Temperature adjustment												-0.1500
adjusted MIT	15.2653	15.7643	16.6278	17.7568	18.7370	19.4202	19.7055	19.6520	19.0991	17.8229	16.3572	15.1815 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8927	0.8582	0.8038	0.7159	0.6024	0.4703	0.3510	0.3979	0.5914	0.7688	0.8638	0.9021 (94)
Useful gains	491.0866	571.0464	640.6597	684.8600	651.8595	511.7291	361.6588	365.7983	467.3722	497.0236	472.6384	464.6105 (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	1493.5690	1475.5749	1371.6667	1183.6115	938.0546	634.9944	409.1139	427.4641	661.5822	962.8347	1240.3008	1479.1415 (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	745.8469	607.8432	543.8692	359.1011	212.9291	0.0000	0.0000	0.0000	0.0000	346.5635	552.7169	754.8111 (98)
Space heating												4123.6810 (98)
Space heating per m2												42.8212 (99)
										(98) / (4) =		

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Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

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													4571.7084 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.8469	607.8432	543.8692	359.1011	212.9291	0.0000	0.0000	0.0000	0.0000	346.5635	552.7169	754.8111	(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)	826.8812	673.8838	602.9592	398.1165	236.0633	0.0000	0.0000	0.0000	0.0000	384.2168	612.7682	836.8194	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater (217)m	88.1821	88.0623	87.7806	87.1117	85.7676	76.4000	76.4000	76.4000	76.4000	86.8898	87.8016	76.4000	(216)
Fuel for water heating, kWh/month	122.6945	107.1635	111.5630	100.6681	99.4978	98.1690	94.1205	105.9296	106.5275	106.6063	112.1607	118.8384	(219)
Water heating fuel used												1283.9387	(219)
Annual totals kWh/year													
Space heating fuel - main system												4571.7084	(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)												394.2382	(232)
Total delivered energy for all uses												6324.8854	(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	4571.7084	0.2160	987.4890 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1283.9387	0.2160	277.3308 (264)
Space and water heating			1264.8198 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.2382	0.5190	204.6096 (268)
Total CO2, kg/year			1508.3544 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6600 (273)

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

DER		15.6600	ZC1
Total Floor Area	TFA	96.3000	
Assumed number of occupants	N	2.7025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3962	ZC2
CO2 emissions from cooking, equation (L16)		1.9093	ZC3
Total CO2 emissions		32.9655	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.9655	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1249 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3749 (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) =	0.3749 (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	0.4779	0.4686	0.4592	0.4123	0.4030	0.3561	0.3561	0.3467	0.3749	0.4030	0.4217	0.4405 (22b)
Effective ac	0.6142	0.6098	0.6054	0.5850	0.5812	0.5634	0.5634	0.5601	0.5703	0.5812	0.5889	0.5970 (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			2.0400	1.0000	2.0400		(26)
TER Opening Type (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Flr - Ground			48.1490	0.1300	6.2594		(28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.1800	9.2576		(29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.1800	12.0919		(29a)
Rf - Ins Joist	48.1490		48.1490	0.1300	6.2594		(30)
Total net area of external elements Aum, m ²			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.8741	(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)							11.3128 (36)
Total fabric heat loss						(33) + (36) =	74.1869 (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	48.7004	48.3487	48.0040	46.3850	46.0821	44.6720	44.6720	44.4108	45.2151	46.0821	46.6949	47.3355 (38)
Heat transfer coeff	122.8873	122.5356	122.1909	120.5719	120.2690	118.8589	118.8589	118.5977	119.4020	120.2690	120.8818	121.5224 (39)
Average = Sum(39)m / 12 =												120.5704 (39)
HLP	1.2761	1.2724	1.2689	1.2520	1.2489	1.2343	1.2343	1.2315	1.2399	1.2489	1.2553	1.2619 (40)
HLP (average)												1.2520 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (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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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	47.5483	47.1278	43.6668	45.1224	47.1278	47.5483	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	211.4515	186.3952	195.8059	173.8295	168.2976	148.2271	142.0129	158.3111	160.0594	182.0798	192.4437	206.3874 (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	211.4515	186.3952	195.8059	173.8295	168.2976	148.2271	142.0129	158.3111	160.0594	182.0798	192.4437	206.3874 (64)
Heat gains from water heating, kWh/month	66.1035	58.1791	60.9014	53.8756	52.0709	45.6830	43.4967	48.7504	49.2970	56.3374	59.9191	64.4197 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3573	19.8576	16.1493	12.2260	9.1391	7.7156	8.3370	10.8367	14.5451	18.4683	21.5552	22.9787 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127 (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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013 (71)
Water heating gains (Table 5)	88.8488	86.5761	81.8567	74.8272	69.9878	63.4486	58.4633	65.5247	68.4681	75.7223	83.2209	86.5856 (72)
Total internal gains	427.9478	425.7717	410.8013	385.9200	360.4113	335.9238	320.5202	327.4850	340.6794	365.7854	393.9532	415.2663 (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
Northeast			7.2210		11.2829	0.6300		0.7000		0.7700		24.8995 (75)
Southeast			5.2480		36.7938	0.6300		0.7000		0.7700		59.0120 (77)
Southwest			0.7190		36.7938	0.6300		0.7000		0.7700		8.0849 (79)
Northwest			7.1650		11.2829	0.6300		0.7000		0.7700		24.7064 (81)
Solar gains	116.7030	215.2654	338.3017	492.5310	618.6342	643.6134	608.2551	509.6736	391.0012	249.7146	142.7839	97.9318 (83)
Total gains	544.6508	641.0371	749.1030	878.4509	979.0455	979.5371	928.7752	837.1586	731.6806	615.5001	536.7371	513.1981 (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	54.4198	54.5760	54.7299	55.4648	55.6045	56.2642	56.2642	56.3881	56.0083	55.6045	55.3227	55.0310
alpha	4.6280	4.6384	4.6487	4.6977	4.7070	4.7509	4.7509	4.7592	4.7339	4.7070	4.6882	4.6687
util living area	0.9984	0.9963	0.9894	0.9611	0.8749	0.7085	0.5464	0.6193	0.8707	0.9816	0.9968	0.9988 (86)
MIT	19.5619	19.7273	20.0162	20.4115	20.7490	20.9359	20.9851	20.9740	20.8208	20.3806	19.9041	19.5387 (87)
Th 2	19.8596	19.8625	19.8653	19.8786	19.8811	19.8927	19.8927	19.8948	19.8882	19.8811	19.8760	19.8708 (88)
util rest of house	0.9979	0.9950	0.9854	0.9457	0.8268	0.6118	0.4173	0.4861	0.8013	0.9718	0.9954	0.9984 (89)
MIT 2	17.9486	18.1920	18.6140	19.1874	19.6363	19.8508	19.8874	19.8843	19.7408	19.1542	18.4603	17.9222 (90)
Living area fraction									fLA = Living area / (4) =			0.1967 (91)
MIT	18.2659	18.4939	18.8898	19.4281	19.8552	20.0642	20.1033	20.0986	19.9532	19.3954	18.7443	18.2401 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2659	18.4939	18.8898	19.4281	19.8552	20.0642	20.1033	20.0986	19.9532	19.3954	18.7443	18.2401 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9966	0.9926	0.9804	0.9377	0.8255	0.6280	0.4428	0.5122	0.8061	0.9658	0.9932	0.9974 (94)
Useful gains	542.8136	636.3141	734.4548	823.7419	808.2208	615.1764	411.2666	428.7721	589.8422	594.4245	533.1060	511.8814 (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	1716.2337	1665.7401	1513.9204	1269.3960	980.8142	649.4693	416.3985	438.6463	698.8893	1057.8114	1407.5823	1706.1915 (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	873.0246	691.7743	579.9224	320.8709	128.4095	0.0000	0.0000	0.0000	0.0000	344.7598	629.6229	888.5668 (98)
Space heating												4456.9512 (98)
Space heating per m2										(98) / (4) =		46.2819 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													4771.8963 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	873.0246	691.7743	579.9224	320.8709	128.4095	0.0000	0.0000	0.0000	0.0000	344.7598	629.6229	888.5668	(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)	934.7158	740.6577	620.9019	343.5449	137.4834	0.0000	0.0000	0.0000	0.0000	369.1219	674.1145	951.3563	(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	211.4515	186.3952	195.8059	173.8295	168.2976	148.2271	142.0129	158.3111	160.0594	182.0798	192.4437	206.3874	(64)
Efficiency of water heater (217)m	88.2361	88.0493	87.6183	86.5738	84.3800	80.3000	80.3000	80.3000	80.3000	86.6340	87.8144	80.3000	(216)
Fuel for water heating, kWh/month	239.6429	211.6940	223.4762	200.7877	199.4520	184.5917	176.8529	197.1495	199.3268	210.1712	219.1484	233.7172	(219)
Water heating fuel used												2496.0105	(219)
Annual totals kWh/year													
Space heating fuel - main system												4771.8963	(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)												394.8373	(232)
Total delivered energy for all uses												7737.7441	(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	4771.8963	0.2160	1030.7296 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2496.0105	0.2160	539.1383 (264)
Space and water heating			1569.8679 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.8373	0.5190	204.9205 (268)
Total CO2, kg/m2/year			1813.7134 (272)
Emissions per m2 for space and water heating			16.3018 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1279 (272b)
Emissions per m2 for pumps and fans			0.4042 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3018 * 1.00) + 2.1279 + 0.4042, rounded to 2 d.p.			18.8300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	022 - PRJ013014	Issued on Date	08/02/2024
Assessment Reference	022	Prop Type Ref	D
Property	6 Deeble way, Netley Abbey, Southampton, SO31 5JP		

SAP Rating	85 B	DER	15.66	TER	18.83
Environmental	86 B	% DER<TER	16.85		
CO ₂ Emissions (t/year)	1.26	DFEE	52.62	TFEE	59.95
General Requirements Compliance	Pass	% DFEE<TFEE	12.23		

Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk	Assessor ID	U903-0001
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Client	
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1249 (8)
Pressure test					Yes
Measured/design AP50					4.5700
Infiltration rate					0.3534 (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) =	0.3534 (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	0.4505	0.4417	0.4329	0.3887	0.3799	0.3357	0.3357	0.3269	0.3534	0.3799	0.3975	0.4152 (22b)
Effective ac	0.6015	0.5975	0.5937	0.5755	0.5721	0.5563	0.5563	0.5534	0.5624	0.5721	0.5790	0.5862 (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			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Fir - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.8403		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.8319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)
Total fabric heat loss							(33) + (36) = 86.5106 (37)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.6914	47.3789	47.0726	45.6340	45.3648	44.1118	44.1118	43.8798	44.5944	45.3648	45.9093	46.4786	(38)
Heat transfer coeff	134.2020	133.8895	133.5832	132.1446	131.8754	130.6224	130.6224	130.3904	131.1051	131.8754	132.4199	132.9892	(39)
Average = Sum(39)m / 12 =												132.1433	(39)
HLP	1.3936	1.3903	1.3872	1.3722	1.3694	1.3564	1.3564	1.3540	1.3614	1.3694	1.3751	1.3810	(40)
HLP (average)												1.3722	(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												2.7025	(42)	
Average daily hot water use (litres/day)												98.3851	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237	(44)	
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285	(45)	
Energy content (annual)												Total = Sum(45)m =	1547.9814	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Heat gains from water heating, kWh/month	34.1047	29.8282	30.7800	26.8347	25.7486	22.2191	20.5892	23.6264	23.9086	27.8632	30.4148	33.0286	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3234	19.8274	16.1248	12.2075	9.1252	7.7039	8.3243	10.8203	14.5230	18.4403	21.5225	22.9438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	45.8396	44.3871	41.3710	37.2705	34.6083	30.8598	27.6737	31.7560	33.2064	37.4505	42.2428	44.3932	(72)
Total internal gains	381.9047	380.5526	367.2911	345.3447	322.0180	300.3233	286.7179	290.6998	302.3956	324.4856	349.9425	370.0391	(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	
Northeast				7.2210	11.2829	0.7300		0.7200		0.7700		29.6762 (75)	
Southeast				5.2480	36.7938	0.7300		0.7200		0.7700		70.3327 (77)	
Southwest				0.7190	36.7938	0.7300		0.7200		0.7700		9.6359 (79)	
Northwest				7.1650	11.2829	0.7300		0.7200		0.7700		29.4461 (81)	
Solar gains		139.0909	256.5612	403.2004	587.0165	737.3110	767.0820	724.9407	607.4477	466.0096	297.6191	170.1751	116.7187 (83)
Total gains		520.9956	637.1138	770.4915	932.3612	1059.3290	1067.4053	1011.6586	898.1475	768.4052	622.1047	520.1176	486.7578 (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	12.7234	12.7531	12.7823	12.9215	12.9478	13.0721	13.0721	13.0953	13.0239	12.9478	12.8946	12.8394		
alpha	1.8482	1.8502	1.8522	1.8614	1.8632	1.8715	1.8715	1.8730	1.8683	1.8632	1.8596	1.8560		
util living area	0.9474	0.9238	0.8823	0.8057	0.6972	0.5701	0.4620	0.5161	0.7030	0.8602	0.9297	0.9532	(86)	
MIT	17.2852	17.6641	18.3201	19.1810	19.9519	20.5084	20.7681	20.7053	20.2144	19.2032	18.0917	17.2161	(87)	
Th 2	19.7683	19.7707	19.7732	19.7847	19.7869	19.7969	19.7969	19.7988	19.7930	19.7869	19.7825	19.7779	(88)	
util rest of house	0.9406	0.9141	0.8669	0.7792	0.6529	0.4995	0.3625	0.4168	0.6418	0.8350	0.9191	0.9471	(89)	
MIT 2	16.3973	16.7721	17.4173	18.2572	18.9816	19.4822	19.6871	19.6499	19.2472	18.3000	17.2079	16.3351	(90)	
Living area fraction									fLA = Living area / (4) =			0.1967	(91)	
MIT	16.5719	16.9475	17.5949	18.4389	19.1725	19.6841	19.8997	19.8575	19.4374	18.4777	17.3817	16.5084	(92)	
Temperature adjustment												0.0000		
adjusted MIT	16.5719	16.9475	17.5949	18.4389	19.1725	19.6841	19.8997	19.8575	19.4374	18.4777	17.3817	16.5084	(93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9153	0.8833	0.8309	0.7431	0.6270	0.4922	0.3718	0.4222	0.6205	0.7995	0.8897	0.9236	(94)
Useful gains	476.8845	562.7322	640.1916	692.8275	664.1858	525.3398	376.1752	379.1873	476.8025	497.3754	462.7669	449.5774	(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													
	1646.9157	1613.0342	1482.0880	1260.5090	985.4357	664.0910	431.0168	450.8199	699.7595	1038.8697	1361.5063	1636.8841	(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													
	870.5033	705.8030	626.3710	408.7307	239.0099	0.0000	0.0000	0.0000	0.0000	402.8718	647.0923	883.3562	(98)
Space heating												4783.7381	(98)
Space heating per m2											(98) / (4) =	49.6754	(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	1227.8508	966.6059	990.9669	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6823	0.7392	0.6998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	837.7721	714.5122	693.5268	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1350.5304	1283.1622	1152.2797	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	369.1860	423.0756	341.3122	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1133.5738	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	92.2965	105.7689	85.3280	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												283.3934	(107)
Space cooling per m2												2.9428	(108)
Energy for space heating												49.6754	(99)
Energy for space cooling												2.9428	(108)
Total												52.6182	(109)
Dwelling Fabric Energy Efficiency (DFEE)												52.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1249 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3749 (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) =	0.3749 (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	0.4779	0.4686	0.4592	0.4123	0.4030	0.3561	0.3561	0.3467	0.3749	0.4030	0.4217	0.4405 (22b)
Effective ac	0.6142	0.6098	0.6054	0.5850	0.5812	0.5634	0.5634	0.5601	0.5703	0.5812	0.5889	0.5970 (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			2.0400	1.0000	2.0400		(26)
TER Opening Type (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Floor - Ground			48.1490	0.1300	6.2594		(28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.1800	9.2576		(29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.1800	12.0919		(29a)
Rf - Ins Joist	48.1490		48.1490	0.1300	6.2594		(30)
Total net area of external elements Aum, m ²			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.8741	(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)							11.3128 (36)
Total fabric heat loss						(33) + (36) =	74.1869 (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	48.7004	48.3487	48.0040	46.3850	46.0821	44.6720	44.6720	44.4108	45.2151	46.0821	46.6949	47.3355 (38)
Heat transfer coeff	122.8873	122.5356	122.1909	120.5719	120.2690	118.8589	118.8589	118.5977	119.4020	120.2690	120.8818	121.5224 (39)
Average = Sum(39)m / 12 =												120.5704 (39)
HLP	1.2761	1.2724	1.2689	1.2520	1.2489	1.2343	1.2343	1.2315	1.2399	1.2489	1.2553	1.2619 (40)
HLP (average)												1.2520 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1047	29.8282	30.7800	26.8347	25.7486	22.2191	20.5892	23.6264	23.9086	27.8632	30.4148	33.0286 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3573	19.8576	16.1493	12.2260	9.1391	7.7156	8.3370	10.8367	14.5451	18.4683	21.5552	22.9787	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	45.8396	44.3871	41.3710	37.2705	34.6083	30.8598	27.6737	31.7560	33.2064	37.4505	42.2428	44.3932	(72)
Total internal gains	381.9386	380.5827	367.3156	345.3633	322.0318	300.3350	286.7306	290.7163	302.4177	324.5136	349.9752	370.0739	(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			
Northeast				7.2210	11.2829	0.6300	0.7000	0.7700	24.8995 (75)			
Southeast				5.2480	36.7938	0.6300	0.7000	0.7700	59.0120 (77)			
Southwest				0.7190	36.7938	0.6300	0.7000	0.7700	8.0849 (79)			
Northwest				7.1650	11.2829	0.6300	0.7000	0.7700	24.7064 (81)			
Solar gains	116.7030	215.2654	338.3017	492.5310	618.6342	643.6134	608.2551	509.6736	391.0012	249.7146	142.7839	97.9318 (83)
Total gains	498.6416	595.8481	705.6173	837.8942	940.6661	943.9483	894.9856	800.3898	693.4189	574.2282	492.7591	468.0057 (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	54.4198	54.5760	54.7299	55.4648	55.6045	56.2642	56.2642	56.3881	56.0083	55.6045	55.3227	55.0310	
alpha	4.6280	4.6384	4.6487	4.6977	4.7070	4.7509	4.7509	4.7592	4.7339	4.7070	4.6882	4.6687	
util living area	0.9989	0.9973	0.9916	0.9672	0.8879	0.7270	0.5645	0.6423	0.8885	0.9860	0.9978	0.9992	(86)
MIT	19.5184	19.6849	19.9766	20.3790	20.7286	20.9284	20.9830	20.9697	20.8006	20.3441	19.8626	19.4957	(87)
Th 2	19.8596	19.8625	19.8653	19.8786	19.8811	19.8927	19.8927	19.8948	19.8882	19.8811	19.8760	19.8708	(88)
util rest of house	0.9985	0.9963	0.9884	0.9538	0.8428	0.6306	0.4324	0.5067	0.8242	0.9783	0.9968	0.9989	(89)
MIT 2	18.5114	18.6798	18.9721	19.3764	19.6980	19.8602	19.8885	19.8863	19.7735	19.3499	18.8682	18.4975	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	18.7095	18.8775	19.1697	19.5736	19.9007	20.0703	20.1038	20.0994	19.9755	19.5454	19.0638	18.6938	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7095	18.8775	19.1697	19.5736	19.9007	20.0703	20.1038	20.0994	19.9755	19.5454	19.0638	18.6938	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9951	0.9857	0.9491	0.8437	0.6475	0.4587	0.5335	0.8304	0.9750	0.9958	0.9985	(94)
Ext temp.	497.6244	592.9399	695.5431	795.2529	793.6569	611.2011	410.5024	427.0305	575.7958	559.8898	490.6674	467.2993	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1770.7393	1712.7356	1548.1215	1286.9311	986.2862	650.1968	416.4525	438.7365	701.5446	1075.8585	1446.2051	1761.3241	(97)
Space heating kWh	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	947.1975	752.5027	634.3183	354.0083	143.3162	0.0000	0.0000	0.0000	0.0000	383.8807	687.9871	962.7545	(98)
Space heating per m2												4865.9653	(98)
												50.5292	(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	1117.2733	879.5556	901.3428	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8562	0.9156	0.8792	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	956.5898	805.2989	792.4348	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.2456	1146.8080	1038.0394	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	179.7522	254.0827	182.7299	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												616.5648 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	44.9380	63.5207	45.6825	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												154.1412 (107)
Space cooling per m2												1.6006 (108)
Energy for space heating												50.5292 (99)
Energy for space cooling												1.6006 (108)
Total												52.1299 (109)
Target Fabric Energy Efficiency (TFEE)												59.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	022 - PRJ013014	Issued on Date	08/02/2024
Assessment Reference	022	Prop Type Ref	D
Property	6 Deeble way, Netley Abbey, Southampton, SO31 5JP		

SAP Rating	85 B	DER	15.66	TER	18.83
Environmental	86 B	% DER<TER	16.85		
CO ₂ Emissions (t/year)	1.26	DFEE	52.62	TTEE	59.95
General Requirements Compliance	Pass	% DFEE<TTEE	12.23		

Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk	Assessor ID	U903-0001
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Client	
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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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
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								4 * 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)+(7a)+(7b)+(7c) =							40.0000 / (5) =	0.1665 (8)			
Pressure test								Yes				
Measured/design AP50								4.5700				
Infiltration rate								0.3950 (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) =	0.3950 (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 infiltr rate	0.4839	0.4542	0.4444	0.4147	0.4147	0.4049	0.4049	0.3950	0.3950	0.4246	0.4246	0.4345 (22b)
Effective ac	0.6171	0.6032	0.5987	0.5860	0.5860	0.5820	0.5820	0.5780	0.5780	0.5901	0.5901	0.5944 (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			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Fir - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum, m ²			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.8403		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.8319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)
Total fabric heat loss							(33) + (36) = 86.5106 (37)

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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9255	47.8238	47.4721	46.4631	46.4631	46.1423	46.1423	45.8292	45.8292	46.7917	46.7917	47.1280	(38)
Heat transfer coeff	135.4361	134.3344	133.9827	132.9738	132.9738	132.6529	132.6529	132.3398	132.3398	133.3023	133.3023	133.6386	(39)
Average = Sum(39)m / 12 =												133.3275	(39)
HLP	1.4064	1.3950	1.3913	1.3808	1.3808	1.3775	1.3775	1.3742	1.3742	1.3842	1.3842	1.3877	(40)
HLP (average)												1.3845	(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												2.7025	(42)
Average daily hot water use (litres/day)												98.3851	(43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237	(44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285	(45)
Energy content (annual)										Total = Sum(45)m =		1547.9814	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143	(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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(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)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(64)
RHI water heating demand										Total per year (kWh/year) = Sum(64)m =		1554.5770	(64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(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	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8085	49.5686	40.3119	30.5187	22.8131	19.2598	20.8109	27.0507	36.3075	46.1007	53.8063	57.3596	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	612.1661	607.5297	583.7807	546.7540	508.6198	474.5124	454.5861	463.3642	484.6696	521.9210	563.3850	594.9698	(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	
Northeast					7.2210	14.6130	0.7300	0.7200	0.7700		38.4350 (75)	
Southeast					5.2480	45.0642	0.7300	0.7200	0.7700		86.1418 (77)	
Southwest					0.7190	45.0642	0.7300	0.7200	0.7700		11.8018 (79)	
Northwest					7.1650	14.6130	0.7300	0.7200	0.7700		38.1369 (81)	

Solar gains	174.5155	275.5550	444.1437	655.9726	778.6086	894.4746	817.0587	712.3794	542.6257	350.3206	213.1662	143.7377 (83)
Total gains	786.6816	883.0848	1027.9244	1202.7266	1287.2284	1368.9870	1271.6448	1175.7436	1027.2953	872.2416	776.5512	738.7075 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	12.6074	12.7108	12.7442	12.8409	12.8409	12.8720	12.8720	12.9024	12.9024	12.8092	12.8092	12.7770	
alpha	1.8405	1.8474	1.8496	1.8561	1.8561	1.8581	1.8581	1.8602	1.8602	1.8539	1.8539	1.8518	
util living area	0.8885	0.8635	0.8068	0.7086	0.5824	0.4163	0.3116	0.3237	0.5349	0.7373	0.8490	0.8964	(86)
MIT	18.0973	18.3677	18.9728	19.7234	20.3568	20.7718	20.9111	20.9081	20.6177	19.8973	18.9360	18.0822	(87)
Th 2	19.7584	19.7672	19.7700	19.7781	19.7781	19.7806	19.7806	19.7831	19.7831	19.7754	19.7754	19.7728	(88)
util rest of house	0.8745	0.8467	0.7826	0.6716	0.5255	0.3354	0.2070	0.2124	0.4517	0.6919	0.8265	0.8832	(89)

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MIT 2	16.0739	16.4516	17.2897	18.3082	19.1292	19.6099	19.7413	19.7440	19.4667	18.5720	17.2605	16.0585 (90)
Living area fraction									fLA = Living area / (4) =			0.1967 (91)
MIT	16.4719	16.8284	17.6208	18.5866	19.3707	19.8384	19.9713	19.9730	19.6931	18.8327	17.5900	16.4565 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.3219	16.6784	17.4708	18.4366	19.2207	19.6884	19.8213	19.8230	19.5431	18.6827	17.4400	16.3065 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8180	0.7881	0.7242	0.6231	0.4963	0.3288	0.2107	0.2163	0.4331	0.6415	0.7677	0.8282	(94)
Useful gains	643.5291	695.9769	744.4233	749.4081	638.8053	450.1465	267.9313	254.3432	444.9135	559.5474	596.1722	611.8102	(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													
	1438.5884	1421.0479	1309.1143	1108.5458	813.8874	502.5438	281.4033	267.7223	535.0583	850.8224	1151.7386	1404.0745	(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													
	591.5241	487.2477	420.1301	258.5792	130.2611	0.0000	0.0000	0.0000	0.0000	216.7086	400.0078	589.4446	(98)
Space heating												3093.9031	(98)
RHI space heating demand												3094	(98)

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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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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) =	0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.5700
Infiltration rate					0.3950 (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) =		0.3950 (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	0.5036	0.4937	0.4839	0.4345	0.4246	0.3752	0.3752	0.3654	0.3950	0.4246	0.4444	0.4641 (22b)
Effective ac	0.6268	0.6219	0.6171	0.5944	0.5901	0.5704	0.5704	0.5667	0.5780	0.5901	0.5987	0.6077 (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			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.8403		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.8319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)
Total fabric heat loss							(33) + (36) = 86.5106 (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	49.6986	49.3082	48.9255	47.1280	46.7917	45.2262	45.2262	44.9362	45.8292	46.7917	47.4721	48.1833 (38)
Heat transfer coeff	136.2092	135.8188	135.4361	133.6386	133.3023	131.7368	131.7368	131.4469	132.3398	133.3023	133.9827	134.6939 (39)
Average = Sum(39)m / 12 =												133.6370 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4144	1.4104	1.4064	1.3877	1.3842	1.3680	1.3680	1.3650	1.3742	1.3842	1.3913	1.3987 (40)
HLP (average)												1.3877 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m												

	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495 (61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780 (62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970 eq. (G10)
Total of WWHRS savings												-475.8342
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811 (64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8443	0.8105	0.7573	0.6719	0.5617	0.4320	0.3163	0.3563	0.5375	0.7121	0.8107	0.8544 (94)
Useful gains	634.2953	700.3662	747.4279	761.7348	699.8069	536.3440	373.0736	381.5041	511.0052	583.5622	594.7313	608.0854 (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	1555.4761	1531.9199	1418.1894	1216.0972	957.0524	643.8899	412.9980	432.9380	678.7120	1000.0638	1293.2213	1540.6810 (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	685.3585	558.8041	499.0465	327.1409	191.3907	0.0000	0.0000	0.0000	0.0000	309.8772	502.9128	693.8511 (98)
Space heating												3768.3818 (98)
Space heating per m2												39.1317 (99)
										(98) / (4) =		

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8c. Space cooling requirement

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												4177.8068 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	685.3585	558.8041	499.0465	327.1409	191.3907	0.0000	0.0000	0.0000	0.0000	309.8772	502.9128	693.8511 (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)	759.8209	619.5167	553.2666	362.6839	212.1848	0.0000	0.0000	0.0000	0.0000	343.5445	557.5530	769.2363 (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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811 (64)
Efficiency of water heater (217)m	88.0320	87.9059	87.6042	86.8825	85.4408	76.4000	76.4000	76.4000	76.4000	86.6002	87.6087	76.4000 (216)
Fuel for water heating, kWh/month	122.9037	107.3541	111.7877	100.9336	99.8783	98.1690	94.1205	105.9296	106.5275	106.9629	112.4076	119.0340 (219)
Water heating fuel used												1286.0085 (219)
Annual totals kWh/year												
Space heating fuel - main system												4177.8068 (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)												394.2382 (232)
Total delivered energy for all uses												5933.0536 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4177.8068	3.4800	145.3877 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1286.0085	3.4800	44.7531 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.2382	13.1900	52.0000 (250)
Additional standing charges			120.0000 (251)
Total energy cost			372.0333 (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] =	1.1058 (257)
SAP value		84.5737
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	4177.8068	0.2160	902.4063 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1286.0085	0.2160	277.7778 (264)
Space and water heating			1180.1841 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.2382	0.5190	204.6096 (268)
Total kg/year			1423.7188 (272)
CO2 emissions per m2			14.7800 (273)
EI value			86.4984
EI rating			86 (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	$3.48 / 0.8365 = 4.160$, stars = 5
Water heating environmental impact	$0.216 / 0.8365 = 0.2582$, 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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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					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) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.5700
Infiltration rate					0.3950 (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) =	0.3950 (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	0.4839	0.4542	0.4444	0.4147	0.4147	0.4049	0.4049	0.3950	0.3950	0.4246	0.4246	0.4345 (22b)
Effective ac	0.6171	0.6032	0.5987	0.5860	0.5860	0.5820	0.5820	0.5780	0.5780	0.5901	0.5901	0.5944 (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			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.8403		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.8319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)
Total fabric heat loss							(33) + (36) = 86.5106 (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	48.9255	47.8238	47.4721	46.4631	46.4631	46.1423	46.1423	45.8292	45.8292	46.7917	46.7917	47.1280 (38)
Heat transfer coeff	135.4361	134.3344	133.9827	132.9738	132.9738	132.6529	132.6529	132.3398	132.3398	133.3023	133.3023	133.6386 (39)
Average = Sum(39)m / 12 =												133.3275 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4064	1.3950	1.3913	1.3808	1.3808	1.3775	1.3775	1.3742	1.3742	1.3842	1.3842	1.3877 (40)
HLP (average)												1.3845 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m												

	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495 (61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780 (62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970 eq. (G10)
Total of WWHRS savings												-475.8342
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811 (64)
								Total per year (kWh/year) = Sum(64)m =				1078.7427 (64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8085	49.5686	40.3119	30.5187	22.8131	19.2598	20.8109	27.0507	36.3075	46.1007	53.8063	57.3596 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177 (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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013 (71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806 (72)
Total internal gains	612.1661	607.5297	583.7807	546.7540	508.6198	474.5124	454.5861	463.3642	484.6696	521.9210	563.3850	594.9698 (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		
Northeast				7.2210	14.6130	0.7300		0.7200		0.7700		38.4350 (75)
Southeast				5.2480	45.0642	0.7300		0.7200		0.7700		86.1418 (77)
Southwest				0.7190	45.0642	0.7300		0.7200		0.7700		11.8018 (79)
Northwest				7.1650	14.6130	0.7300		0.7200		0.7700		38.1367 (81)
Solar gains	174.5155	275.5550	444.1437	655.9726	778.6086	894.4746	817.0587	712.3794	542.6257	350.3206	213.1662	143.7377 (83)
Total gains	786.6816	883.0848	1027.9244	1202.7266	1287.2284	1368.9870	1271.6448	1175.7436	1027.2953	872.2416	776.5512	738.7075 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
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	12.6074	12.7108	12.7442	12.8409	12.8409	12.8720	12.8720	12.9024	12.9024	12.8092	12.8092	12.7770
alpha	1.8405	1.8474	1.8496	1.8561	1.8561	1.8581	1.8581	1.8602	1.8602	1.8539	1.8539	1.8518
util living area	0.8885	0.8635	0.8068	0.7086	0.5824	0.4163	0.3116	0.3237	0.5349	0.7373	0.8490	0.8964 (86)
MIT	18.0973	18.3677	18.9728	19.7234	20.3568	20.7718	20.9111	20.9081	20.6177	19.8973	18.9360	18.0822 (87)
Th 2	19.7584	19.7672	19.7700	19.7781	19.7781	19.7806	19.7806	19.7831	19.7831	19.7754	19.7754	19.7728 (88)
util rest of house	0.8745	0.8467	0.7826	0.6716	0.5255	0.3354	0.2070	0.2124	0.4517	0.6919	0.8265	0.8832 (89)
MIT 2	16.0739	16.4516	17.2897	18.3082	19.1292	19.6099	19.7413	19.7440	19.4667	18.5720	17.2605	16.0585 (90)
Living area fraction	16.4719	16.8284	17.6208	18.5866	19.3707	19.8384	19.9713	19.9730	19.6931	18.8327	17.5900	16.1967 (91)
MIT	16.4719	16.8284	17.6208	18.5866	19.3707	19.8384	19.9713	19.9730	19.6931	18.8327	17.5900	16.4565 (92)
Temperature adjustment	16.3219	16.6784	17.4708	18.4366	19.2207	19.6884	19.8213	19.8230	19.5431	18.6827	17.4400	-0.1500
adjusted MIT	16.3219	16.6784	17.4708	18.4366	19.2207	19.6884	19.8213	19.8230	19.5431	18.6827	17.4400	16.3065 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8180	0.7881	0.7242	0.6231	0.4963	0.3288	0.2107	0.2163	0.4331	0.6415	0.7677	0.8282 (94)
Useful gains	643.5291	695.9769	744.4233	749.4081	638.8053	450.1465	267.9313	254.3432	444.9135	559.5474	596.1722	611.8102 (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	1438.5884	1421.0479	1309.1143	1108.5458	813.8874	502.5438	281.4033	267.7223	535.0583	850.8224	1151.7386	1404.0745 (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	591.5241	487.2477	420.1301	258.5792	130.2611	0.0000	0.0000	0.0000	0.0000	216.7086	400.0078	589.4446 (98)
Space heating												3093.9031 (98)
Space heating per m2												32.1278 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

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													3430.0478 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	591.5241	487.2477	420.1301	258.5792	130.2611	0.0000	0.0000	0.0000	0.0000	216.7086	400.0078	589.4446	(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)	655.7917	540.1859	465.7761	286.6731	144.4136	0.0000	0.0000	0.0000	0.0000	240.2535	443.4676	653.4863	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater (217)m	87.7492	87.6317	87.2218	86.2544	84.1814	76.4000	76.4000	76.4000	76.4000	85.5716	87.0922	76.4000	(216)
Fuel for water heating, kWh/month	123.2998	107.6901	112.2778	101.6687	101.3725	98.1690	94.1205	105.9296	106.5275	108.2486	113.0743	119.4487	(219)
Water heating fuel used												1291.8269	(219)
Annual totals kWh/year													
Space heating fuel - main system												3430.0478	(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)												394.2382	(232)
Total delivered energy for all uses												5191.1130	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3430.0478	7.6100	261.0266 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1291.8269	7.6100	98.3080 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	394.2382	31.0800	122.5292 (250)
Additional standing charges			105.0000 (251)
Total energy cost			610.1739 (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	3430.0478	0.2160	740.8903 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.8269	0.2160	279.0346 (264)
Space and water heating			1019.9249 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.2382	0.5190	204.6096 (268)
Total kg/year			1263.4596 (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	3430.0478	1.2200	4184.6584 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.8269	1.2200	1576.0288 (264)
Space and water heating			5760.6872 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	394.2382	3.0700	1210.3113 (268)
Primary energy kWh/year			7201.2485 (272)
Primary energy kWh/m2/year			74.7793 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

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	+ 9.4	-£ 605	-1010 kg (80.0%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 46	-148 kg (11.7%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£605 10.49 kg/m²	A 94	A 95
Total Savings	£605 10.49 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 536 TEST (31 Jan 2024)
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	£146	£146	£0
Mains gas	£464	£464	£0
Space heating	£389	£389	£0
Water heating	£98	£98	£0
Lighting	£123	£123	£0
Generated (PV)	-£0	-£605	£605
Total cost of fuels	£610	£5	£605
Total cost of uses	£610	£5	£605
Delivered energy	54 kWh/m²	34 kWh/m²	20 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.3 tonnes	1.0 tonnes
CO2 emissions per m²	13 kg/m²	3 kg/m²	10 kg/m²
Primary energy	75 kWh/m²	13 kWh/m²	62 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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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					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) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.5700
Infiltration rate					0.3950 (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) =	0.3950 (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	0.5036	0.4937	0.4839	0.4345	0.4246	0.3752	0.3752	0.3654	0.3950	0.4246	0.4444	0.4641 (22b)
Effective ac	0.6268	0.6219	0.6171	0.5944	0.5901	0.5704	0.5704	0.5667	0.5780	0.5901	0.5987	0.6077 (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			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2860				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.8403		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.8319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)
Total fabric heat loss							(33) + (36) = 86.5106 (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	49.6986	49.3082	48.9255	47.1280	46.7917	45.2262	45.2262	44.9362	45.8292	46.7917	47.4721	48.1833 (38)
Heat transfer coeff	136.2092	135.8188	135.4361	133.6386	133.3023	131.7368	131.7368	131.4469	132.3398	133.3023	133.9827	134.6939 (39)
Average = Sum(39)m / 12 =												133.6370 (39)
HLP	1.4144	1.4104	1.4064	1.3877	1.3842	1.3680	1.3680	1.3650	1.3742	1.3842	1.3913	1.3987 (40)
HLP (average)												1.3877 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m												

[illegible]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8443	0.8105	0.7573	0.6719	0.5617	0.4320	0.3163	0.3563	0.5375	0.7121	0.8107	0.8544 (94)
Useful gains	634.2953	700.3662	747.4279	761.7348	699.8069	536.3440	373.0736	381.5041	511.0052	583.5622	594.7313	608.0854 (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	1555.4761	1531.9199	1418.1894	1216.0972	957.0524	643.8899	412.9980	432.9380	678.7120	1000.0638	1293.2213	1540.6810 (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	685.3585	558.8041	499.0465	327.1409	191.3907	0.0000	0.0000	0.0000	0.0000	309.8772	502.9128	693.8511 (98)
Space heating												3768.3818 (98)
Space heating per m2												39.1317 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8c. Space cooling requirement

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													4177.8068 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	685.3585	558.8041	499.0465	327.1409	191.3907	0.0000	0.0000	0.0000	0.0000	309.8772	502.9128	693.8511	(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)	759.8209	619.5167	553.2666	362.6839	212.1848	0.0000	0.0000	0.0000	0.0000	343.5445	557.5530	769.2363	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater (217)m	88.0320	87.9059	87.6042	86.8825	85.4408	76.4000	76.4000	76.4000	76.4000	86.6002	87.6087	76.4000	(216)
Fuel for water heating, kWh/month	122.9037	107.3541	111.7877	100.9336	99.8783	98.1690	94.1205	105.9296	106.5275	106.9629	112.4076	119.0340	(219)
Water heating fuel used												1286.0085	(219)
Annual totals kWh/year													
Space heating fuel - main system												4177.8068	(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)												394.2382	(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												4205.8142	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4177.8068	3.4800	145.3877 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1286.0085	3.4800	44.7531 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.2382	13.1900	52.0000 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			144.2104 (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] =	0.4287 (257)
SAP value		94.0203
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	4177.8068	0.2160	902.4063 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1286.0085	0.2160	277.7778 (264)
Space and water heating			1180.1841 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.2382	0.5190	204.6096 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			527.2815 (272)
CO2 emissions per m2			5.4800 (273)
EI value			94.9996
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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1665 (8)
Pressure test										Yes							
Measured/design AP50																	4.5700
Infiltration rate																	0.3950 (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) =							0.3950 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4839	0.4542	0.4444	0.4147	0.4147	0.4049	0.4049	0.3950	0.3950	0.4246	0.4246	0.4345	(22b)				
Effective ac	0.6171	0.6032	0.5987	0.5860	0.5860	0.5820	0.5820	0.5780	0.5780	0.5901	0.5901	0.5944	(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			2.0400	1.2000	2.4480		(26)					
Windows (Uw = 1.40)			20.3500	1.3258	26.9659		(27)					
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)					
Wl - Brick (Timber Frame)	65.6430	14.2120	51.4310	0.2100	10.8005	7.4000	380.5894 (29a)					
Wl - Clad (Timber Frame)	75.3550	8.1780	67.1770	0.2100	14.1072	7.4000	497.1098 (29a)					
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)					
Total net area of external elements Aum(A, m2)			237.2860				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.8403		(33)					
Stud			75.7215			7.4000	560.3391 (32c)					
Internal Floor			48.1490			7.4000	356.3026 (32d)					
Internal Ceiling			48.1490			7.4000	356.3026 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6147.0105 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							63.8319 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6703 (36)					
Total fabric heat loss						(33) + (36) =	86.5106 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.9255	Feb 47.8238	Mar 47.4721	Apr 46.4631	May 46.4631	Jun 46.1423	Jul 46.1423	Aug 45.8292	Sep 45.8292	Oct 46.7917	Nov 46.7917	Dec 47.1280 (38)
Heat transfer coeff	135.4361	134.3344	133.9827	132.9738	132.9738	132.6529	132.6529	132.3398	132.3398	133.3023	133.3023	133.6386 (39)
Average = Sum(39)m / 12 =												133.3275 (39)
HLP	Jan 1.4064	Feb 1.3950	Mar 1.3913	Apr 1.3808	May 1.3808	Jun 1.3775	Jul 1.3775	Aug 1.3742	Sep 1.3742	Oct 1.3842	Nov 1.3842	Dec 1.3877 (40)
HLP (average)												1.3845 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	Jan 108.2237	Feb 104.2883	Mar 100.3528	Apr 96.4174	May 92.4820	Jun 88.5466	Jul 88.5466	Aug 92.4820	Sep 96.4174	Oct 100.3528	Nov 104.2883	Dec 108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m												

	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495 (61)
Total heat required for water heating calculated for each month												
WWHRS	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780 (62)
Total of WWHRS savings	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-475.8342
Output from w/h								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811 (64)
								Total per year (kWh/year) = Sum(64)m =				1078.7427 (64)
Heat gains from water heating, kWh/month												
	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8085	49.5686	40.3119	30.5187	22.8131	19.2598	20.8109	27.0507	36.3075	46.1007	53.8063	57.3596 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177 (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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013 (71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806 (72)
Total internal gains	612.1661	607.5297	583.7807	546.7540	508.6198	474.5124	454.5861	463.3642	484.6696	521.9210	563.3850	594.9698 (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			
Northeast				7.2210	14.6130	0.7300		0.7200	0.7700		38.4350 (75)	
Southeast				5.2480	45.0642	0.7300		0.7200	0.7700		86.1418 (77)	
Southwest				0.7190	45.0642	0.7300		0.7200	0.7700		11.8018 (79)	
Northwest				7.1650	14.6130	0.7300		0.7200	0.7700		38.1369 (81)	

Solar gains	174.5155	275.5550	444.1437	655.9726	778.6086	894.4746	817.0587	712.3794	542.6257	350.3206	213.1662	143.7377 (83)
Total gains	786.6816	883.0848	1027.9244	1202.7266	1287.2284	1368.9870	1271.6448	1175.7436	1027.2953	872.2416	776.5512	738.7075 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
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	12.6074	12.7108	12.7442	12.8409	12.8409	12.8720	12.8720	12.9024	12.9024	12.8092	12.8092	12.7770
alpha	1.8405	1.8474	1.8496	1.8561	1.8561	1.8581	1.8581	1.8602	1.8602	1.8539	1.8539	1.8518
util living area	0.8885	0.8635	0.8068	0.7086	0.5824	0.4163	0.3116	0.3237	0.5349	0.7373	0.8490	0.8964 (86)
MIT	18.0973	18.3677	18.9728	19.7234	20.3568	20.7718	20.9111	20.9081	20.6177	19.8973	18.9360	18.0822 (87)
Th 2	19.7584	19.7672	19.7700	19.7781	19.7781	19.7806	19.7806	19.7831	19.7831	19.7754	19.7754	19.7728 (88)
util rest of house	0.8745	0.8467	0.7826	0.6716	0.5255	0.3354	0.2070	0.2124	0.4517	0.6919	0.8265	0.8832 (89)
MIT 2	16.0739	16.4516	17.2897	18.3082	19.1292	19.6099	19.7413	19.7440	19.4667	18.5720	17.2605	16.0585 (90)
Living area fraction	16.4719	16.8284	17.6208	18.5866	19.3707	19.8384	19.9713	19.9730	19.6931	18.8327	17.5900	16.1967 (91)
MIT	16.4719	16.8284	17.6208	18.5866	19.3707	19.8384	19.9713	19.9730	19.6931	18.8327	17.5900	16.4565 (92)
Temperature adjustment	16.3219	16.6784	17.4708	18.4366	19.2207	19.6884	19.8213	19.8230	19.5431	18.6827	17.4400	-0.1500
adjusted MIT	16.3219	16.6784	17.4708	18.4366	19.2207	19.6884	19.8213	19.8230	19.5431	18.6827	17.4400	16.3065 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8180	0.7881	0.7242	0.6231	0.4963	0.3288	0.2107	0.2163	0.4331	0.6415	0.7677	0.8282 (94)
Useful gains	643.5291	695.9769	744.4233	749.4081	638.8053	450.1465	267.9313	254.3432	444.9135	559.5474	596.1722	611.8102 (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	1438.5884	1421.0479	1309.1143	1108.5458	813.8874	502.5438	281.4033	267.7223	535.0583	850.8224	1151.7386	1404.0745 (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	591.5241	487.2477	420.1301	258.5792	130.2611	0.0000	0.0000	0.0000	0.0000	216.7086	400.0078	589.4446 (98)
Space heating												3093.9031 (98)
Space heating per m2												32.1278 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

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													3430.0478 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	591.5241	487.2477	420.1301	258.5792	130.2611	0.0000	0.0000	0.0000	0.0000	216.7086	400.0078	589.4446	(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)	655.7917	540.1859	465.7761	286.6731	144.4136	0.0000	0.0000	0.0000	0.0000	240.2535	443.4676	653.4863	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater (217)m	87.7492	87.6317	87.2218	86.2544	84.1814	76.4000	76.4000	76.4000	76.4000	85.5716	87.0922	76.4000	(216)
Fuel for water heating, kWh/month	123.2998	107.6901	112.2778	101.6687	101.3725	98.1690	94.1205	105.9296	106.5275	108.2486	113.0743	119.4487	(219)
Water heating fuel used												1291.8269	(219)
Annual totals kWh/year													
Space heating fuel - main system												3430.0478	(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)												394.2382	(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												3244.6670	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3430.0478	7.6100	261.0266 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1291.8269	7.6100	98.3080 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	394.2382	31.0800	122.5292 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	31.0800	-604.9554 (252)
Total energy cost			5.2185 (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	3430.0478	0.2160	740.8903 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.8269	0.2160	279.0346 (264)
Space and water heating			1019.9249 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.2382	0.5190	204.6096 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	0.5190	-1010.2054 (269)
Total kg/year			253.2541 (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	3430.0478	1.2200	4184.6584 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.8269	1.2200	1576.0288 (264)
Space and water heating			5760.6872 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	394.2382	3.0700	1210.3113 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	3.0700	-5975.5890 (269)
Primary energy kWh/year			1225.6595 (272)
Primary energy kWh/m2/year			12.7275 (273)