

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	001 - PRJ013014			Issued on Date	30/11/2023
Assessment Reference	001	Prop Type Ref	D-SP		
Property	1 Deeble Way, Netley Abbey, Southampton, SO31 5JP				
SAP Rating	85 B	DER	14.51	TER	17.09
Environmental	88 B	% DER<TER	15.08		
CO ₂ Emissions (t/year)	1.16	DFEE	47.26	TFEE	51.09
General Requirements Compliance	Pass	% DFEE<TFEE	7.50		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

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

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DWELLING AS BUILT

Semi-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) 17.09 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.51 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)47.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.17 (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: 4.61 (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: 6.05 m², No overhang

Windows facing South East: 8.37 m², No overhang

Windows facing South West: 6.16 m², No overhang

Windows facing North West: 0.81 m², No overhang

Air change rate: 4.68 ach

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

10 Key features

Party wall U-value 0.00 W/m²K
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	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1673 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3978 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3680 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	48.1228	47.7856	47.4551	45.9028	45.6124	44.2604	44.2604	44.0100	44.7811	45.6124	46.1999	46.8142 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	128.3090	127.9718	127.6413	126.0890	125.7986	124.4466	124.4466	124.1962	124.9674	125.7986	126.3861	127.0004 (39)
												126.0876 (39)
HLP	1.3384	1.3348	1.3314	1.3152	1.3122	1.2981	1.2981	1.2955	1.3035	1.3122	1.3183	1.3247 (40)
HLP (average)												1.3152 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

Energy content (annual)										Total = Sum(45)m =			1546.2366 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880 (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	0.6508	0.5467	0.5031	0.4157	0.3852	0.4617	0.4871	0.5892	0.6206	0.6496 (61)	
Total heat required for water heating calculated for each month													
	160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028 (62)	
WWHRS	-52.8897	-46.5364	-47.4963	-39.0773	-36.2834	-29.9315	-25.3312	-30.6705	-31.5656	-39.0222	-45.2032	-51.1206 eq.(G10)	
Total of WWHRS savings												-475.1281	
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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822 (64)	
								Total per year (kWh/year) = Sum(64)m =			1077.6976 (64)		
Heat gains from water heating, kWh/month	53.4713	46.7719	48.2701	42.0778	40.3693	34.8310	32.2761	37.0422	37.4895	43.6958	47.6918	51.7841 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2407	19.7540	16.0650	12.1623	9.0914	7.6754	8.2935	10.7802	14.4692	18.3719	21.4428	22.8588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.4730	252.0617	245.5382	231.6503	214.1193	197.6426	186.6352	184.0465	190.5701	204.4579	221.9889	238.4656 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893 (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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145 (71)
Water heating gains (Table 5)	71.8700	69.6010	64.8791	58.4414	54.2598	48.3764	43.3818	49.7879	52.0688	58.7310	66.2386	69.6023 (72)
Total internal gains	410.0516	407.8846	392.9502	368.7219	343.9385	320.1624	304.7785	311.0825	323.5760	348.0288	376.1383	397.3946 (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					6.0470	11.2829	0.7300		0.7200			0.7700	24.8514 (75)
Southeast					8.3730	36.7938	0.7300		0.7200			0.7700	112.2134 (77)
Southwest					6.1640	36.7938	0.7300		0.7200			0.7700	82.6088 (79)
Northwest					0.8120	11.2829	0.7300		0.7200			0.7700	3.3371 (81)
Solar gains	223.0107	389.2327	557.4352	732.3752	858.3702	868.8994	830.7468	734.1902	617.6156	436.8907	268.8205	189.7473 (83)	
Total gains	633.0623	797.1174	950.3855	1101.0971	1202.3087	1189.0618	1135.5253	1045.2727	941.1916	784.9195	644.9587	587.1420 (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 _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.4238	13.4592	13.4941	13.6602	13.6917	13.8405	13.8405	13.8684	13.7828	13.6917	13.6281	13.5622
alpha	1.8949	1.8973	1.8996	1.9107	1.9128	1.9227	1.9227	1.9246	1.9189	1.9128	1.9085	1.9041
util living area	0.9280	0.8919	0.8396	0.7565	0.6477	0.5215	0.4125	0.4531	0.6283	0.8055	0.9012	0.9364 (86)
MIT	17.6156	18.0591	18.7019	19.4773	20.1388	20.6093	20.8247	20.7834	20.4013	19.5119	18.4192	17.5328 (87)
Th 2	19.8109	19.8136	19.8163	19.8289	19.8313	19.8423	19.8423	19.8444	19.8381	19.8313	19.8265	19.8215 (88)
util rest of house	0.9192	0.8793	0.8206	0.7270	0.6026	0.4542	0.3224	0.3625	0.5654	0.7749	0.8874	0.9286 (89)
MIT 2	15.4006	16.0251	16.9260	17.9997	18.8846	19.4837	19.7229	19.6881	19.2490	18.0769	16.5497	15.2857 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.1967 (91)
MIT	15.8363	16.4252	17.2754	18.2904	19.1313	19.7052	19.9396	19.9036	19.4756	18.3592	16.9175	15.7278 (92)
Temperature adjustment												-0.1500
adjusted MIT	15.6863	16.2752	17.1254	18.1404	18.9813	19.5552	19.7896	19.7536	19.3256	18.2092	16.7675	15.5778 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8725	0.8251	0.7633	0.6748	0.5648	0.4358	0.3180	0.3547	0.5332	0.7195	0.8348	0.8847 (94)
Useful gains	552.3455	657.7384	725.4317	743.0395	679.0405	518.2119	361.0586	370.7623	501.8761	564.7431	538.3869	519.4520 (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	1460.9686	1455.7065	1356.2341	1165.1138	915.9799	616.6537	396.9404	416.5028	653.0343	957.2222	1221.8352	1444.9803 (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	676.0156	536.2346	469.3170	303.8935	176.2829	0.0000	0.0000	0.0000	0.0000	292.0044	492.0827	688.5931 (98)
Space heating												3634.4238 (98)
Space heating per m2												37.9099 (99)
										(98) / (4) =		

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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													4029.2947 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	676.0156	536.2346	469.3170	303.8935	176.2829	0.0000	0.0000	0.0000	0.0000	292.0044	492.0827	688.5931	(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)	749.4630	594.4951	520.3071	336.9108	195.4356	0.0000	0.0000	0.0000	0.0000	323.7300	545.5463	763.4069	(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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Efficiency of water heater (217)m	88.0086	87.8278	87.4743	86.6958	85.1844	76.4000	76.4000	76.4000	76.4000	86.4425	87.5646	76.4000	(216)
Fuel for water heating, kWh/month	122.8206	107.3485	111.8480	101.0525	100.0805	98.0714	94.0252	105.8234	106.4211	107.0538	112.3568	118.9378	(219)
Water heating fuel used													1285.8396 (219)
Annual totals kWh/year													
Space heating fuel - main system													4029.2947 (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)													392.7777 (232)
Total delivered energy for all uses													5782.9120 (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	4029.2947	0.2160	870.3277	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1285.8396	0.2160	277.7414	(264)
Space and water heating			1148.0690	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	392.7777	0.5190	203.8516	(268)
Total CO2, kg/year			1390.8456	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5100	(273)

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

DER			14.5100	ZC1
Total Floor Area		TFA	95.8700	
Assumed number of occupants		N	2.6979	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.4201	ZC2
CO2 emissions from cooking, equation (L16)			1.9166	ZC3
Total CO2 emissions			31.8467	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			31.8467	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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					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) = 0.1255 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3755 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3473 (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	0.4429	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3473	0.3734	0.3908	0.4081 (22b)
Effective ac	0.5981	0.5943	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (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)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1300	6.3115		(28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.1800	7.9022		(29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.1800	5.9915		(29a)
Rf - Ins Joist	47.3200		47.3200	0.1300	6.1516		(30)
Rf - Flat over Bay	1.2330		1.2330	0.1300	0.1603		(30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.9150		(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)							11.5662 (36)
Total fabric heat loss						(33) + (36) =	68.4812 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	47.1752	46.8748	46.5804	45.1975	44.9388	43.7343	43.7343	43.5112	44.1982	44.9388	45.4622	46.0094 (38)
Heat transfer coeff	115.6564	115.3560	115.0616	113.6787	113.4200	112.2155	112.2155	111.9925	112.6794	113.4200	113.9434	114.4906 (39)
Average = Sum(39)m / 12 =												113.6775 (39)
HLP	1.2064	1.2033	1.2002	1.1858	1.1831	1.1705	1.1705	1.1682	1.1753	1.1831	1.1885	1.1942 (40)
HLP (average)												1.1857 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)
Energy content (annual)										Total = Sum(45)m =		1546.2366 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	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	50.9589	46.0274	50.9589	47.4947	47.0747	43.6176	45.0715	47.0747	47.4947	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	211.2706	186.2370	195.6427	173.6335	168.1079	148.0600	141.8528	158.1326	159.8790	181.9320	192.2824	206.2122 (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	211.2706	186.2370	195.6427	173.6335	168.1079	148.0600	141.8528	158.1326	159.8790	181.9320	192.2824	206.2122 (64)
Heat gains from water heating, kWh/month	66.0434	58.1265	60.8471	53.8148	52.0122	45.6315	43.4477	48.6954	49.2415	56.2883	59.8654	64.3614 (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)
(66)m	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2403	19.7536	16.0647	12.1620	9.0913	7.6752	8.2933	10.7800	14.4689	18.3716	21.4424	22.8584	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.4730	252.0617	245.5382	231.6503	214.1193	197.6426	186.6352	184.0465	190.5701	204.4579	221.9889	238.4656	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	(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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	(71)
Water heating gains (Table 5)	88.7679	86.4978	81.7837	74.7428	69.9089	63.3771	58.3974	65.4509	68.3909	75.6563	83.1464	86.5073	(72)
Total internal gains	426.9491	424.7811	409.8545	385.0230	359.5874	335.1629	319.7939	326.7453	339.8978	364.9538	393.0456	414.2992	(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			6.0470		11.2829		0.6300		0.7000		0.7700		20.8513 (75)
Southeast			8.3730		36.7938		0.6300		0.7000		0.7700		94.1517 (77)
Southwest			6.1640		36.7938		0.6300		0.7000		0.7700		69.3122 (79)
Northwest			0.8120		11.2829		0.6300		0.7000		0.7700		2.7999 (81)
Solar gains	187.1151	326.5823	467.7111	614.4929	720.2079	729.0423	697.0307	616.0157	518.2049	366.5692	225.5514	159.2058	(83)
Total gains	614.0642	751.3634	877.5656	999.5159	1079.7953	1064.2052	1016.8246	942.7610	858.1027	731.5230	618.5971	573.5050	(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	57.5640	57.7138	57.8615	58.5654	58.6990	59.3290	59.3290	59.4472	59.0848	58.6990	58.4294	58.1501	
alpha	4.8376	4.8476	4.8574	4.9044	4.9133	4.9553	4.9553	4.9631	4.9390	4.9133	4.8953	4.8767	
util living area	0.9973	0.9926	0.9786	0.9327	0.8210	0.6403	0.4785	0.5338	0.7881	0.9614	0.9939	0.9981	(86)
MIT	19.7210	19.9217	20.2141	20.5686	20.8361	20.9641	20.9930	20.9883	20.9013	20.5362	20.0574	19.6871	(87)
Th 2	19.9149	19.9174	19.9199	19.9314	19.9336	19.9437	19.9437	19.9455	19.9398	19.9336	19.9292	19.9246	(88)
util rest of house	0.9964	0.9901	0.9712	0.9096	0.7655	0.5486	0.3673	0.4178	0.7061	0.9434	0.9914	0.9974	(89)
MIT 2	18.2190	18.5128	18.9362	19.4398	19.7805	19.9211	19.9412	19.9410	19.8653	19.4080	18.7202	18.1764	(90)
Living area fraction	18.5145	18.7899	19.1876	19.6618	19.9882	20.1263	20.1482	20.1471	20.0691	19.6299	18.9833	18.4736	(92)
Temperature adjustment	18.5145	18.7899	19.1876	19.6618	19.9882	20.1263	20.1482	20.1471	20.0691	19.6299	18.9833	18.4736	(93)
adjusted MIT	18.5145	18.7899	19.1876	19.6618	19.9882	20.1263	20.1482	20.1471	20.0691	19.6299	18.9833	18.4736	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9863	0.9645	0.9025	0.7686	0.5653	0.3893	0.4406	0.7173	0.9366	0.9881	0.9961	(94)
Useful gains	610.7717	741.0859	846.4426	902.0971	829.9655	601.5806	395.8234	415.4158	615.4969	685.1791	611.2660	571.2455	(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	1643.9975	1602.2888	1459.8572	1223.3922	940.0464	620.1369	398.1577	419.6417	672.6004	1024.1751	1354.0178	1634.1871	(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	768.7200	578.7284	456.3804	231.3325	81.9002	0.0000	0.0000	0.0000	0.0000	252.2131	534.7813	790.8285	(98)
Space heating												3694.8844	(98)
Space heating per m2												38.5406	(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													3955.9790 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	768.7200	578.7284	456.3804	231.3325	81.9002	0.0000	0.0000	0.0000	0.0000	252.2131	534.7813	790.8285	(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)	823.0407	619.6235	488.6300	247.6793	87.6876	0.0000	0.0000	0.0000	0.0000	270.0354	572.5710	846.7115	(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	211.2706	186.2370	195.6427	173.6335	168.1079	148.0600	141.8528	158.1326	159.8790	181.9320	192.2824	206.2122	(64)
Efficiency of water heater (217)m	88.0134	87.7140	87.1123	85.7743	83.3507	80.3000	80.3000	80.3000	80.3000	85.8737	87.4898	88.1080	(216)
Fuel for water heating, kWh/month	240.0435	212.3229	224.5866	202.4307	201.6875	184.3836	176.6535	196.9273	199.1022	211.8599	219.7771	234.0449	(219)
Water heating fuel used												2503.8197	(219)
Annual totals kWh/year													
Space heating fuel - main system												3955.9790	(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)												392.7701	(232)
Total delivered energy for all uses												6927.5688	(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	3955.9790	0.2160	854.4915 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2503.8197	0.2160	540.8251 (264)
Space and water heating			1395.3165 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.7701	0.5190	203.8477 (268)
Total CO2, kg/m2/year			1638.0892 (272)
Emissions per m2 for space and water heating			14.5543 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1263 (272b)
Emissions per m2 for pumps and fans			0.4060 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5543 * 1.00) + 2.1263 + 0.4060, rounded to 2 d.p.			17.0900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1255 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3560 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3293 (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	0.4199	0.4116	0.4034	0.3622	0.3540	0.3128	0.3128	0.3046	0.3293	0.3540	0.3705	0.3869 (22b)
Effective ac	0.5881	0.5847	0.5814	0.5656	0.5627	0.5489	0.5489	0.5464	0.5542	0.5627	0.5686	0.5749 (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)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	46.3927	46.1227	45.8580	44.6150	44.3825	43.2999	43.2999	43.0994	43.7169	44.3825	44.8529	45.3448 (38)
Heat transfer coeff	126.5789	126.3089	126.0443	124.8013	124.5687	123.4861	123.4861	123.2856	123.9031	124.5687	125.0392	125.5310 (39)
Average = Sum(39)m / 12 =												124.8002 (39)
HLP	1.3203	1.3175	1.3147	1.3018	1.2994	1.2881	1.2881	1.2860	1.2924	1.2994	1.3043	1.3094 (40)
HLP (average)												1.3018 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1546.2366 (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	34.0662	29.7945	30.7453	26.8045	25.7196	22.1940	20.5660	23.5998	23.8817	27.8318	30.3806	32.9913 (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)
(66)m	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2407	19.7540	16.0650	12.1623	9.0914	7.6754	8.2935	10.7802	14.4692	18.3719	21.4428	22.8588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.4730	252.0617	245.5382	231.6503	214.1193	197.6426	186.6352	184.0465	190.5701	204.4579	221.9889	238.4656	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	(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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	(71)
Water heating gains (Table 5)	45.7879	44.3371	41.3243	37.2285	34.5693	30.8250	27.6425	31.7202	33.1690	37.4083	42.1952	44.3432	(72)
Total internal gains	380.9695	379.6208	366.3954	344.5089	321.2479	299.6110	286.0392	290.0148	301.6762	323.7061	349.0949	369.1355	(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					6.0470	11.2829	0.7300	0.7200	0.7700		24.8514 (75)	
Southeast					8.3730	36.7938	0.7300	0.7200	0.7700		112.2134 (77)	
Southwest					6.1640	36.7938	0.7300	0.7200	0.7700		82.6088 (79)	
Northwest					0.8120	11.2829	0.7300	0.7200	0.7700		3.3371 (81)	

Solar gains	223.0107	389.2327	557.4352	732.3752	858.3702	868.8994	830.7468	734.1902	617.6156	436.8907	268.8205	189.7473 (83)
Total gains	603.9802	768.8535	923.8307	1076.8841	1179.6182	1168.5104	1116.7860	1024.2050	919.2918	760.5968	617.9153	558.8828 (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	13.6073	13.6364	13.6650	13.8011	13.8269	13.9481	13.9481	13.9708	13.9012	13.8269	13.7749	13.7209
alpha	1.9072	1.9091	1.9110	1.9201	1.9218	1.9299	1.9299	1.9314	1.9267	1.9218	1.9183	1.9147
util living area	0.9327	0.8968	0.8444	0.7611	0.6518	0.5254	0.4158	0.4579	0.6342	0.8120	0.9068	0.9410 (86)
MIT	17.5991	18.0482	18.6966	19.4731	20.1374	20.6077	20.8242	20.7814	20.3961	19.4992	18.3984	17.5110 (87)
Th 2	19.8250	19.8271	19.8293	19.8394	19.8413	19.8502	19.8502	19.8518	19.8468	19.8413	19.8375	19.8335 (88)
util rest of house	0.9246	0.8847	0.8259	0.7321	0.6071	0.4584	0.3258	0.3673	0.5718	0.7821	0.8938	0.9337 (89)
MIT 2	16.7394	17.1802	17.8129	18.5636	19.1815	19.5996	19.7667	19.7419	19.4330	18.6097	17.5392	16.6583 (90)
Living area fraction	16.9085	17.3510	17.9867	18.7425	19.3696	19.7979	19.9747	19.9464	19.6224	18.7847	17.7082	16.8260 (92)
Temperature adjustment	16.9085	17.3510	17.9867	18.7425	19.3696	19.7979	19.9747	19.9464	19.6224	18.7847	17.7082	16.8260 (93)
adjusted MIT	16.9085	17.3510	17.9867	18.7425	19.3696	19.7979	19.9747	19.9464	19.6224	18.7847	17.7082	16.8260 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8964	0.8511	0.7898	0.6998	0.5867	0.4551	0.3362	0.3754	0.5581	0.7486	0.8617	0.9076 (94)
Useful gains	541.4289	654.3363	729.6401	753.6286	692.0543	531.8104	375.4528	384.4581	513.0765	569.3508	532.4846	507.2393 (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	1595.9753	1572.6723	1447.8345	1228.3609	955.3902	641.8678	416.7272	437.2185	684.2471	1019.5582	1326.4453	1584.9597 (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	784.5825	617.1218	534.3366	341.8072	195.9219	0.0000	0.0000	0.0000	0.0000	334.9543	571.6517	801.8240 (98)
Space heating												4182.2001 (99)
Space heating per m2	(98) / (4) =											43.6237 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1160.7693	913.7971	936.9706	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7327	0.7874	0.7594	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	850.4472	719.5312	711.5689	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1468.4415	1405.7814	1299.3536	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	444.9559	510.5701	437.3118	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1392.8378 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	111.2390	127.6425	109.3279	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												348.2095 (107)
Energy for space heating												3.6321 (108)
Energy for space cooling												43.6237 (99)
Total												3.6321 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.2558 (109)
												47.3 (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	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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					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) = 0.1255 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3755 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3473 (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	0.4429	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3473	0.3734	0.3908	0.4081 (22b)
Effective ac	0.5981	0.5943	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (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)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1300	6.3115		(28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.1800	7.9022		(29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.1800	5.9915		(29a)
Rf - Ins Joist	47.3200		47.3200	0.1300	6.1516		(30)
Rf - Flat over Bay	1.2330		1.2330	0.1300	0.1603		(30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.9150		(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)							11.5662 (36)
Total fabric heat loss						(33) + (36) =	68.4812 (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	47.1752	46.8748	46.5804	45.1975	44.9388	43.7343	43.7343	43.5112	44.1982	44.9388	45.4622	46.0094 (38)
Heat transfer coeff	115.6564	115.3560	115.0616	113.6787	113.4200	112.2155	112.2155	111.9925	112.6794	113.4200	113.9434	114.4906 (39)
Average = Sum(39)m / 12 =												113.6775 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2064	1.2033	1.2002	1.1858	1.1831	1.1705	1.1705	1.1682	1.1753	1.1831	1.1885	1.1942 (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													2.6979 (42)
Average daily hot water use (litres/day)													98.2742 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)
Energy content (annual)												Total = Sum(45)m = 1546.2366 (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												

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 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	34.0662	29.7945	30.7453	26.8045	25.7196	22.1940	20.5660	23.5998	23.8817	27.8318	30.3806	32.9913 (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	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932	134.8932 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2403	19.7536	16.0647	12.1620	9.0913	7.6752	8.2933	10.7800	14.4689	18.3716	21.4424	22.8584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.4730	252.0617	245.5382	231.6503	214.1193	197.6426	186.6352	184.0465	190.5701	204.4579	221.9889	238.4656 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893	36.4893 (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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145 (71)
Water heating gains (Table 5)	45.7879	44.3371	41.3243	37.2285	34.5693	30.8250	27.6425	31.7202	33.1690	37.4083	42.1952	44.3432 (72)
Total internal gains	380.9691	379.6204	366.3951	344.5087	321.2478	299.6108	286.0390	290.0146	301.6759	323.7058	349.0944	369.1351 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.0470	11.2829	0.6300	0.7000	0.7700	20.8513 (75)
Southeast	8.3730	36.7938	0.6300	0.7000	0.7700	94.1517 (77)
Southwest	6.1640	36.7938	0.6300	0.7000	0.7700	69.3122 (79)
Northwest	0.8120	11.2829	0.6300	0.7000	0.7700	2.7999 (81)

Solar gains	187.1151	326.5823	467.7111	614.4929	720.2079	729.0423	697.0307	616.0157	518.2049	366.5692	225.5514	159.2058 (83)
Total gains	568.0842	706.2026	834.1062	959.0016	1041.4557	1028.6532	983.0697	906.0303	819.8808	690.2750	574.6459	528.3409 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.5640	57.7138	57.8615	58.5654	58.6990	59.3290	59.3290	59.4472	59.0848	58.6990	58.4294	58.1501
alpha	4.8376	4.8476	4.8574	4.9044	4.9133	4.9553	4.9553	4.9631	4.9390	4.9133	4.8953	4.8767
util living area	0.9981	0.9943	0.9825	0.9414	0.8361	0.6579	0.4939	0.5532	0.8088	0.9689	0.9955	0.9987 (86)
MIT	19.6769	19.8793	20.1759	20.5399	20.8208	20.9596	20.9920	20.9864	20.8885	20.5026	20.0158	19.6436 (87)
Th 2	19.9149	19.9174	19.9199	19.9314	19.9336	19.9437	19.9437	19.9455	19.9398	19.9336	19.9292	19.9246 (88)
util rest of house	0.9974	0.9923	0.9763	0.9206	0.7826	0.5655	0.3797	0.4341	0.7292	0.9537	0.9937	0.9982 (89)
MIT 2	18.7132	18.9166	19.2114	19.5701	19.8179	19.9261	19.9418	19.9419	19.8811	19.5438	19.0626	18.6876 (90)
Living area fraction									fLA = Living area / (4) =			0.1967 (91)
MIT	18.9028	19.1060	19.4011	19.7609	20.0152	20.1294	20.1484	20.1474	20.0793	19.7324	19.2502	18.8757 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9028	19.1060	19.4011	19.7609	20.0152	20.1294	20.1484	20.1474	20.0793	19.7324	19.2502	18.8757 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	566.1434	699.3624	811.0975	878.9838	819.8339	599.3352	395.4790	414.6839	607.5817	655.7963	570.0795	527.0552 (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	1688.9031	1638.7429	1484.4264	1234.6533	943.1091	620.4891	398.1805	419.6766	673.7457	1035.8005	1384.4298	1680.2256 (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	835.3332	631.2637	500.9567	256.0820	91.7167	0.0000	0.0000	0.0000	0.0000	282.7232	586.3322	857.9588 (98)
Space heating												4042.3666 (98)
Space heating per m2										(98) / (4) =		42.1651 (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	1054.8257	830.3947	851.1426	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9070	0.9515	0.9322	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	956.7795	790.0815	793.4583	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1304.9718	1249.4895	1161.2271	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	250.6984	341.7995	273.6200	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												866.1180 (104)
Cooled fraction									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												
0.0000	0.0000	0.0000	0.0000	0.0000	62.6746	85.4499	68.4050	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												216.5295 (107)
Space cooling per m2												2.2586 (108)
Energy for space heating												42.1651 (99)
Energy for space cooling												2.2586 (108)
Total												44.4237 (109)
Target Fabric Energy Efficiency (TFEE)												51.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1673 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3978 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3680 (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												
Effective ac	0.4508	0.4232	0.4140	0.3864	0.3864	0.3772	0.3772	0.3680	0.3680	0.3956	0.3956	0.4048 (22b)
	0.6016	0.5896	0.5857	0.5747	0.5747	0.5711	0.5711	0.5677	0.5677	0.5783	0.5783	0.5819 (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)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	47.4551	46.5037	46.1999	45.3286	45.3286	45.0515	45.0515	44.7811	44.7811	45.6124	45.6124	45.9028 (38)
Heat transfer coeff	127.6413	126.6899	126.3861	125.5149	125.5149	125.2378	125.2378	124.9674	124.9674	125.7986	125.7986	126.0890 (39)
Average = Sum(39)m / 12 =												125.8203 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3314	1.3215	1.3183	1.3092	1.3092	1.3063	1.3063	1.3035	1.3035	1.3122	1.3122	1.3152 (40)
HLP (average)												1.3124 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1546.2366 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880	(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	0.6508	0.5467	0.5031	0.4157	0.3852	0.4617	0.4871	0.5892	0.6206	0.6496	(61)
Total heat required for water heating calculated for each month	160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028	(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	160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028	(64)
												Total per year (kWh/year) = Sum (64)m =	1552.8256 (64)
RHI water heating demand													1553 (64)
Heat gains from water heating, kWh/month	53.4713	46.7719	48.2701	42.0778	40.3693	34.8310	32.2761	37.0422	37.4895	43.6958	47.6918	51.7841	(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	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.6017	49.3850	40.1626	30.4056	22.7286	19.1884	20.7338	26.9505	36.1729	45.9299	53.6069	57.1471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.3477	376.2115	366.4749	345.7467	319.5810	294.9890	278.5601	274.6962	284.4329	305.1611	331.3267	355.9187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	(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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	(71)
Water heating gains (Table 5)	71.8700	69.6010	64.8791	58.4414	54.2598	48.3764	43.3818	49.7879	52.0688	58.7310	66.2386	69.6023	(72)
Total internal gains	610.6618	606.0398	582.3588	545.4360	507.4117	473.3962	453.5179	462.2770	483.5170	520.6642	562.0146	593.5104	(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				6.0470	14.6130		0.7300		0.7200		0.7700		32.1862 (75)
Southeast				8.3730	45.0642		0.7300		0.7200		0.7700		137.4362 (77)
Southwest				6.1640	45.0642		0.7300		0.7200		0.7700		101.1772 (79)
Northwest				0.8120	14.6130		0.7300		0.7200		0.7700		4.3220 (81)
Solar gains	275.1216	409.5251	599.8636	801.0624	891.1248	998.5589	921.7506	844.1873	702.6664	503.0289	330.7105		230.0279 (83)
Total gains	885.7834	1015.5649	1182.2224	1346.4984	1398.5366	1471.9550	1375.2685	1306.4643	1186.1833	1023.6931	892.7250		823.5383 (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	13.4941	13.5954	13.6281	13.7227	13.7227	13.7530	13.7530	13.7828	13.7828	13.6917	13.6917	13.6602	
alpha	1.8996	1.9064	1.9085	1.9148	1.9148	1.9169	1.9169	1.9189	1.9189	1.9128	1.9128	1.9107	
util living area	0.8646	0.8303	0.7635	0.6621	0.5403	0.3796	0.2789	0.2835	0.4721	0.6784	0.8130	0.8758	(86)
MIT	18.4090	18.7102	19.2912	19.9496	20.4799	20.8235	20.9344	20.9347	20.7186	20.1195	19.2193	18.3723	(87)
Th 2	19.8163	19.8240	19.8265	19.8336	19.8336	19.8359	19.8359	19.8381	19.8381	19.8313	19.8313	19.8289	(88)
util rest of house	0.8488	0.8112	0.7372	0.6246	0.4859	0.3063	0.1877	0.1881	0.3955	0.6310	0.7879	0.8610	(89)
MIT 2	16.5167	16.9352	17.7356	18.6241	19.3074	19.7023	19.8059	19.8095	19.6057	18.8750	17.6606	16.4719	(90)
Living area fraction	16.8890	17.2844	18.0416	18.8849	19.5381	19.9229	20.0279	20.0309	19.8247	19.1198	17.9672	16.8458	(92)
MIT	16.8890	17.2844	18.0416	18.8849	19.5381	19.9229	20.0279	20.0309	19.8247	19.1198	17.9672	16.8458	(92)
Temperature adjustment	16.7390	17.1344	17.8916	18.7349	19.3881	19.7729	19.8779	19.8809	19.6747	18.9698	17.8172	-0.1500	
adjusted MIT	16.7390	17.1344	17.8916	18.7349	19.3881	19.7729	19.8779	19.8809	19.6747	18.9698	17.8172	16.6958	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.7921	0.7541	0.6839	0.5838	0.4630	0.3021	0.1911	0.1918	0.3838	0.5898	0.7318	0.8055	(94)
Useful gains	701.6611	765.8635	808.5498	786.1396	647.5320	444.7226	262.8286	250.5470	455.2251	603.8036	653.2940	663.3394	(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	1409.0318	1397.9474	1288.0814	1083.8049	789.2481	485.0282	272.7562	260.0386	521.6974	839.0509	1134.3515	1373.8384	(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	526.2838	424.7603	356.7715	214.3190	105.4368	0.0000	0.0000	0.0000	0.0000	175.0240	346.3614	528.6113	(98)
Space heating												2677.5681	(98)
RHI space heating demand												2678	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1673 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3978 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	48.1228	47.7856	47.4551	45.9028	45.6124	44.2604	44.2604	44.0100	44.7811	45.6124	46.1999	46.8142 (38)
Heat transfer coeff	128.3090	127.9718	127.6413	126.0890	125.7986	124.4466	124.4466	124.1962	124.9674	125.7986	126.3861	127.0004 (39)
Average = Sum(39)m / 12 =												126.0876 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3384	1.3348	1.3314	1.3152	1.3122	1.2981	1.2981	1.2955	1.3035	1.3122	1.3183	1.3247 (40)
HLP (average)												1.3152 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1546.2366 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880	(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	0.6508	0.5467	0.5031	0.4157	0.3852	0.4617	0.4871	0.5892	0.6206	0.6496	(61)
Total heat required for water heating calculated for each month	160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028	(62)
WWHRS	-52.8897	-46.5364	-47.4963	-39.0773	-36.2834	-29.9315	-25.3312	-30.6705	-31.5656	-39.0222	-45.2032	-51.1206	eq. (G10)
Total of WWHRS savings												-475.1281	
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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Heat gains from water heating, kWh/month	53.4713	46.7719	48.2701	42.0778	40.3693	34.8310	32.2761	37.0422	37.4895	43.6958	47.6918	51.7841	(65)
5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.6017	49.3850	40.1626	30.4056	22.7286	19.1884	20.7338	26.9505	36.1729	45.9299	53.6069	57.1471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.3477	376.2115	366.4749	345.7467	319.5810	294.9890	278.5601	274.6962	284.4329	305.1611	331.3267	355.9187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	(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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	(71)
Water heating gains (Table 5)	71.8700	69.6010	64.8791	58.4414	54.2598	48.3764	43.3818	49.7879	52.0688	58.7310	66.2386	69.6023	(72)
Total internal gains	610.6618	606.0398	582.3588	545.4360	507.4117	473.3962	453.5179	462.2770	483.5170	520.6642	562.0146	593.5104	(73)
6. Solar gains													
[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains						
	m2	Table 6a	W/m2	or Table 6b	Specific data	factor	W						
					Table 6c	Table 6d							
Northeast	6.0470	11.2829	0.7300		0.7200	0.7700	24.8514	(75)					
Southeast	8.3730	36.7938	0.7300		0.7200	0.7700	112.2134	(77)					
Southwest	6.1640	36.7938	0.7300		0.7200	0.7700	82.6088	(79)					
Northwest	0.8120	11.2829	0.7300		0.7200	0.7700	3.3371	(81)					
Solar gains	223.0107	389.2327	557.4352	732.3752	858.3702	868.8994	830.7468	734.1902	617.6156	436.8907	268.8205	189.7473	(83)
Total gains	833.6725	995.2725	1139.7941	1277.8112	1365.7820	1342.2956	1284.2648	1196.4671	1101.1326	957.5549	830.8351	783.2578	(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	13.4238	13.4592	13.4941	13.6602	13.6917	13.8405	13.8405	13.8684	13.7828	13.6917	13.6281	13.5622	
alpha	1.8949	1.8973	1.8996	1.9107	1.9128	1.9227	1.9227	1.9246	1.9189	1.9128	1.9085	1.9041	
util living area	0.8908	0.8520	0.7973	0.7128	0.6049	0.4803	0.3746	0.4095	0.5748	0.7528	0.8576	0.9007	(86)
MIT	17.9532	18.3578	18.9439	19.6483	20.2432	20.6639	20.8527	20.8197	20.4933	19.7069	18.7076	17.8736	(87)
Th 2	19.8109	19.8136	19.8163	19.8289	19.8313	19.8423	19.8423	19.8444	19.8381	19.8313	19.8265	19.8215	(88)
util rest of house	0.8785	0.8360	0.7753	0.6809	0.5589	0.4150	0.2901	0.3242	0.5115	0.7178	0.8395	0.8894	(89)
MIT 2	15.8717	16.4366	17.2519	18.2201	19.0080	19.5379	19.7436	19.7167	19.3481	18.3279	16.9454	15.7631	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	16.2812	16.8145	17.5847	18.5010	19.2510	19.7594	19.9618	19.9336	19.5734	18.5992	17.2921	16.1783	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.1312	16.6645	17.4347	18.3510	19.1010	19.6094	19.8118	19.7836	19.4234	18.4492	17.1421	16.0283	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8242	0.7788	0.7191	0.6333	0.5266	0.4007	0.2877	0.3193	0.4861	0.6667	0.7828	0.8369	(94)
Useful gains	687.0990	775.0729	819.5741	809.2463	719.2763	537.8997	369.5143	382.0493	535.2601	638.4215	650.3882	655.5057	(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	1518.0456	1505.5277	1395.7224	1191.6736	931.0342	623.4019	399.6934	420.2353	665.2529	987.4179	1269.1790	1502.1996	(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	618.2243	490.8656	428.6543	275.3476	157.5479	0.0000	0.0000	0.0000	0.0000	259.6533	445.5293	629.9402	(98)
Space heating												3305.7627	(98)
Space heating per m2												(98) / (4) =	34.4817 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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													3664.9254 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	618.2243	490.8656	428.6543	275.3476	157.5479	0.0000	0.0000	0.0000	0.0000	259.6533	445.5293	629.9402	(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)	685.3928	544.1969	475.2265	305.2635	174.6650	0.0000	0.0000	0.0000	0.0000	287.8640	493.9350	698.3816	(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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Efficiency of water heater (217)m	87.8388	87.6491	87.2707	86.4317	84.8205	76.4000	76.4000	76.4000	76.4000	86.1130	87.3462	76.4000	(216)
Fuel for water heating, kWh/month	123.0580	107.5674	112.1090	101.3612	100.5099	98.0714	94.0252	105.8234	106.4211	107.4634	112.6377	119.1590	(219)
Water heating fuel used												1288.2070	(219)
Annual totals kWh/year													
Space heating fuel - main system												3664.9254	(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)												392.7777	(232)
Total delivered energy for all uses												5420.9100	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3664.9254	3.4800	127.5394 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1288.2070	3.4800	44.8296 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	392.7777	13.1900	51.8074 (250)
Additional standing charges			120.0000 (251)
Total energy cost			354.0689 (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] =	1.0556 (257)
SAP value		85.2737
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	3664.9254	0.2160	791.6239 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1288.2070	0.2160	278.2527 (264)
Space and water heating			1069.8766 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.7777	0.5190	203.8516 (268)
Total kg/year			1312.6532 (272)
CO2 emissions per m2			13.6900 (273)
EI value			87.5136
EI rating			88 (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	$3.48 / 0.8342 = 4.172$, stars = 5
Water heating environmental impact	$0.216 / 0.8342 = 0.2589$, 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	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1673 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3978 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3680 (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												
Effective ac	0.4508	0.4232	0.4140	0.3864	0.3864	0.3772	0.3772	0.3680	0.3680	0.3956	0.3956	0.4048 (22b)
	0.6016	0.5896	0.5857	0.5747	0.5747	0.5711	0.5711	0.5677	0.5677	0.5783	0.5783	0.5819 (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)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	47.4551	46.5037	46.1999	45.3286	45.3286	45.0515	45.0515	44.7811	44.7811	45.6124	45.6124	45.9028 (38)
Heat transfer coeff	127.6413	126.6899	126.3861	125.5149	125.5149	125.2378	125.2378	124.9674	124.9674	125.7986	125.7986	126.0890 (39)
Average = Sum(39)m / 12 =												125.8203 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3314	1.3215	1.3183	1.3092	1.3092	1.3063	1.3063	1.3035	1.3035	1.3122	1.3122	1.3152 (40)
HLP (average)												1.3124 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum (45)m = 1546.2366 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880 (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	0.6508	0.5467	0.5031	0.4157	0.3852	0.4617	0.4871	0.5892	0.6206 (61)
Total heat required for water heating calculated for each month											
160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028 (62)
WWHRS	-52.8897	-46.5364	-47.4963	-39.0773	-36.2834	-29.9315	-25.3312	-30.6705	-31.5656	-39.0222	-45.2032 eq. (G10)
Total of WWHRS savings											
Solar input	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											
108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822 (64)
Heat gains from water heating, kWh/month											
53.4713	46.7719	48.2701	42.0778	40.3693	34.8310	32.2761	37.0422	37.4895	43.6958	47.6918	51.7841 (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	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.6017	49.3850	40.1626	30.4056	22.7286	19.1884	20.7338	26.9505	36.1729	45.9299	53.6069	57.1471 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	372.3477	376.2115	366.4749	345.7467	319.5810	294.9890	278.5601	274.6962	284.4329	305.1611	331.3267	355.9187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850 (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)												
	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145 (71)
Water heating gains (Table 5)												
	71.8700	69.6010	64.8791	58.4414	54.2598	48.3764	43.3818	49.7879	52.0688	58.7310	66.2386	69.6023 (72)
Total internal gains	610.6618	606.0398	582.3588	545.4360	507.4117	473.3962	453.5179	462.2770	483.5170	520.6642	562.0146	593.5104 (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					6.0470	14.6130	0.7300	0.7200	0.7700		32.1862 (75)	
Southeast					8.3730	45.0642	0.7300	0.7200	0.7700		137.4362 (77)	
Southwest					6.1640	45.0642	0.7300	0.7200	0.7700		101.1772 (79)	
Northwest					0.8120	14.6130	0.7300	0.7200	0.7700		4.3220 (81)	

Solar gains	275.1216	409.5251	599.8636	801.0624	891.1248	998.5589	921.7506	844.1873	702.6664	503.0289	330.7105	230.0279 (83)
Total gains	885.7834	1015.5649	1182.2224	1346.4984	1398.5366	1471.9550	1375.2685	1306.4643	1186.1833	1023.6931	892.7250	823.5383 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	13.4941	13.5954	13.6281	13.7227	13.7227	13.7530	13.7530	13.7828	13.7828	13.6917	13.6917	13.6602
alpha	1.8996	1.9064	1.9085	1.9148	1.9148	1.9169	1.9169	1.9189	1.9189	1.9128	1.9128	1.9107
util living area	0.8646	0.8303	0.7635	0.6621	0.5403	0.3796	0.2789	0.2835	0.4721	0.6784	0.8130	0.8758 (86)
MIT	18.4090	18.7102	19.2912	19.9496	20.4799	20.8235	20.9344	20.9347	20.7186	20.1195	19.2193	18.3723 (87)
Th 2	19.8163	19.8240	19.8265	19.8336	19.8336	19.8359	19.8359	19.8381	19.8381	19.8313	19.8313	19.8289 (88)
util rest of house	0.8488	0.8112	0.7372	0.6246	0.4859	0.3063	0.1877	0.1881	0.3955	0.6310	0.7879	0.8610 (89)
MIT 2	16.5167	16.9352	17.7356	18.6241	19.3074	19.7023	19.8059	19.8095	19.6057	18.8750	17.6606	16.4719 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.8890	17.2844	18.0416	18.8849	19.5381	19.9229	20.0279	20.0309	19.8247	19.1198	17.9672	16.8458 (91)
Temperature adjustment												
adjusted MIT	16.7390	17.1344	17.8916	18.7349	19.3881	19.7729	19.8779	19.8809	19.6747	18.9698	17.8172	16.6958 (92)
												-0.1500
												16.6958 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7921	0.7541	0.6839	0.5838	0.4630	0.3021	0.1911	0.1918	0.3838	0.5898	0.7318	0.8055 (94)
Useful gains	701.6611	765.8635	808.5498	786.1396	647.5320	444.7226	262.8286	250.5470	455.2251	603.8036	653.2940	663.3394 (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	1409.0318	1397.9474	1288.0814	1083.8049	789.2481	485.0282	272.7562	260.0386	521.6974	839.0509	1134.3515	1373.8384 (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	526.2838	424.7603	356.7715	214.3190	105.4368	0.0000	0.0000	0.0000	0.0000	175.0240	346.3614	528.6113 (98)
Space heating												
Space heating per m2	(98) / (4) = 27.9292 (99)											

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													2968.4791 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.2838	424.7603	356.7715	214.3190	105.4368	0.0000	0.0000	0.0000	0.0000	175.0240	346.3614	528.6113	(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)	583.4632	470.9095	395.5338	237.6043	116.8922	0.0000	0.0000	0.0000	0.0000	194.0399	383.9927	586.0435	(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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Efficiency of water heater (217)m	87.5068	87.3345	86.8248	85.7079	83.4602	76.4000	76.4000	76.4000	76.4000	84.8963	86.7343	76.4000	(216)
Fuel for water heating, kWh/month	123.5249	107.9549	112.6847	102.2172	102.1480	98.0714	94.0252	105.8234	106.4211	109.0035	113.4324	119.6378	(219)
Water heating fuel used													1294.9445 (219)
Annual totals kWh/year													
Space heating fuel - main system													2968.4791 (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)													392.7777 (232)
Total delivered energy for all uses													4731.2013 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2968.4791	10.2300	303.6754 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1294.9445	10.2300	132.4728 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	392.7777	36.7200	144.2280 (250)
Additional standing charges			103.0000 (251)
Total energy cost			710.9162 (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	2968.4791	0.2160	641.1915 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1294.9445	0.2160	279.7080 (264)
Space and water heating			920.8995 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.7777	0.5190	203.8516 (268)
Total kg/year			1163.6761 (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	2968.4791	1.2200	3621.5445 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1294.9445	1.2200	1579.8323 (264)
Space and water heating			5201.3768 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	392.7777	3.0700	1205.8274 (268)
Primary energy kWh/year			6637.4542 (272)
Primary energy kWh/m2/year			69.2339 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Current energy efficiency rating: B 85
Current environmental impact rating: B 88

(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	+ 9.5	-£ 715	-1010 kg (86.8%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 64	-148 kg (12.7%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£715	10.54 kg/m²	A 95	A 96
Total Savings	£715	10.54 kg/m²		
Potential energy efficiency rating:			A 95	
Potential environmental impact rating:				A 96

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
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	£172	£172	£0
Mains gas	£539	£539	£0
Space heating	£434	£434	£0
Water heating	£132	£132	£0
Lighting	£144	£144	£0
Generated (PV)	-£0	-£715	£715
Total cost of fuels	£711	-£4	£715
Total cost of uses	£710	-£5	£715
Delivered energy	49 kWh/m²	29 kWh/m²	20 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.2 tonnes	1.0 tonnes
CO2 emissions per m²	12 kg/m²	2 kg/m²	11 kg/m²
Primary energy	69 kWh/m²	7 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	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1673 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3978 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	48.1228	47.7856	47.4551	45.9028	45.6124	44.2604	44.2604	44.0100	44.7811	45.6124	46.1999	46.8142 (38)
Heat transfer coeff	128.3090	127.9718	127.6413	126.0890	125.7986	124.4466	124.4466	124.1962	124.9674	125.7986	126.3861	127.0004 (39)
Average = Sum(39)m / 12 =												126.0876 (39)
HLP	1.3384	1.3348	1.3314	1.3152	1.3122	1.2981	1.2981	1.2955	1.3035	1.3122	1.3183	1.3247 (40)
HLP (average)												1.3152 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

Energy content (annual)										Total = Sum(45)m =			1546.2366 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880 (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	0.6508	0.5467	0.5031	0.4157	0.3852	0.4617	0.4871	0.5892	0.6206	0.6496 (61)	
Total heat required for water heating calculated for each month													
	160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028 (62)	
WWHRS	-52.8897	-46.5364	-47.4963	-39.0773	-36.2834	-29.9315	-25.3312	-30.6705	-31.5656	-39.0222	-45.2032	-51.1206 eq. (G10)	
Total of WWHRS savings													
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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822 (64)	
								Total per year (kWh/year) = Sum(64)m =			1077.6976 (64)		
Heat gains from water heating, kWh/month	53.4713	46.7719	48.2701	42.0778	40.3693	34.8310	32.2761	37.0422	37.4895	43.6958	47.6918	51.7841 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.6017	49.3850	40.1626	30.4056	22.7286	19.1884	20.7338	26.9505	36.1729	45.9299	53.6069	57.1471 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.3477	376.2115	366.4749	345.7467	319.5810	294.9890	278.5601	274.6962	284.4329	305.1611	331.3267	355.9187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850 (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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145 (71)
Water heating gains (Table 5)	71.8700	69.6010	64.8791	58.4414	54.2598	48.3764	43.3818	49.7879	52.0688	58.7310	66.2386	69.6023 (72)
Total internal gains	610.6618	606.0398	582.3588	545.4360	507.4117	473.3962	453.5179	462.2770	483.5170	520.6642	562.0146	593.5104 (73)

[Jan					Area	Solar flux	g		FF		Access		Gains
					m2	Table 6a	or Table 6b		Specific data or Table 6c		factor Table 6d		W
Northeast					6.0470	11.2829	0.7300		0.7200		0.7700		24.8514 (75)
Southeast					8.3730	36.7938	0.7300		0.7200		0.7700		112.2134 (77)
Southwest					6.1640	36.7938	0.7300		0.7200		0.7700		82.6088 (79)
Northwest					0.8120	11.2829	0.7300		0.7200		0.7700		3.3371 (81)
Solar gains	223.0107	389.2327	557.4352	732.3752	858.3702	868.8994	830.7468	734.1902	617.6156	436.8907	268.8205	189.7473 (83)	
Total gains	833.6725	995.2725	1139.7941	1277.8112	1365.7820	1342.2956	1284.2648	1196.4671	1101.1326	957.5549	830.8351	783.2578 (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	13.4238	13.4592	13.4941	13.6602	13.6917	13.8405	13.8405	13.8684	13.7828	13.6917	13.6281	13.5622
alpha	1.8949	1.8973	1.8996	1.9107	1.9128	1.9227	1.9227	1.9246	1.9189	1.9128	1.9085	1.9041
util living area	0.8908	0.8520	0.7973	0.7128	0.6049	0.4803	0.3746	0.4095	0.5748	0.7528	0.8576	0.9007 (86)
MIT	17.9532	18.3578	18.9439	19.6483	20.2432	20.6639	20.8527	20.8197	20.4933	19.7069	18.7076	17.8736 (87)
Th 2	19.8109	19.8136	19.8163	19.8289	19.8313	19.8423	19.8423	19.8444	19.8381	19.8313	19.8265	19.8215 (88)
util rest of house	0.8785	0.8360	0.7753	0.6809	0.5589	0.4150	0.2901	0.3242	0.5115	0.7178	0.8395	0.8894 (89)
MIT 2	15.8717	16.4366	17.2519	18.2201	19.0080	19.5379	19.7436	19.7167	19.3481	18.3279	16.9454	15.7631 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.1967 (91)
MIT	16.2812	16.8145	17.5847	18.5010	19.2510	19.7594	19.9618	19.9336	19.5734	18.5992	17.2921	16.1783 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.1312	16.6645	17.4347	18.3510	19.1010	19.6094	19.8118	19.7836	19.4234	18.4492	17.1421	16.0283 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8242	0.7788	0.7191	0.6333	0.5266	0.4007	0.2877	0.3193	0.4861	0.6667	0.7828	0.8369 (94)
Useful gains	687.0990	775.0729	819.5741	809.2463	719.2763	537.8997	369.5143	382.0493	535.2601	638.4215	650.3882	655.5057 (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	1518.0456	1505.5277	1395.7224	1191.6736	931.0342	623.4019	399.6934	420.2353	665.2529	987.4179	1269.1790	1502.1996 (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	618.2243	490.8656	428.6543	275.3476	157.5479	0.0000	0.0000	0.0000	0.0000	259.6533	445.5293	629.9402 (98)
Space heating												3305.7627 (98)
Space heating per m2												34.4817 (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													3664.9254 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	618.2243	490.8656	428.6543	275.3476	157.5479	0.0000	0.0000	0.0000	0.0000	259.6533	445.5293	629.9402	(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)	685.3928	544.1969	475.2265	305.2635	174.6650	0.0000	0.0000	0.0000	0.0000	287.8640	493.9350	698.3816	(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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Efficiency of water heater (217)m	87.8388	87.6491	87.2707	86.4317	84.8205	76.4000	76.4000	76.4000	76.4000	86.1130	87.3462	76.4000	(216)
Fuel for water heating, kWh/month	123.0580	107.5674	112.1090	101.3612	100.5099	98.0714	94.0252	105.8234	106.4211	107.4634	112.6377	119.1590	(219)
Water heating fuel used												1288.2070	(219)
Annual totals kWh/year													
Space heating fuel - main system												3664.9254	(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)												392.7777	(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												3693.6706	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3664.9254	3.4800	127.5394 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1288.2070	3.4800	44.8296 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	392.7777	13.1900	51.8074 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			126.2460 (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] =	0.3764 (257)
SAP value		94.7492
SAP rating (Section 12)		95 (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	3664.9254	0.2160	791.6239 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1288.2070	0.2160	278.2527 (264)
Space and water heating			1069.8766 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.7777	0.5190	203.8516 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			416.2159 (272)
CO2 emissions per m2			4.3400 (273)
EI value			96.0408
EI rating			96 (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	48.5500 (1b)	x 2.3600 (2b)	= 114.5780 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6300 (2c)	= 124.4516 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.8700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 239.0296 (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) = 0.1673 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3978 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3680 (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												
Effective ac	0.4508	0.4232	0.4140	0.3864	0.3864	0.3772	0.3772	0.3680	0.3680	0.3956	0.3956	0.4048 (22b)
	0.6016	0.5896	0.5857	0.5747	0.5747	0.5711	0.5711	0.5677	0.5677	0.5783	0.5783	0.5819 (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)			21.4000	1.3258	28.3580		(27)
Flr - Ground			48.5500	0.1700	8.2535	75.6000	3670.3800 (28a)
Wl - Brick (Timber Frame)	61.8100	17.9090	43.9010	0.2100	9.2192	7.6200	334.5256 (29a)
Wl - Clad (Timber Frame)	38.8100	5.5240	33.2860	0.2100	6.9901	7.4000	246.3164 (29a)
Rf - Ins Joist	47.3200		47.3200	0.0800	3.7856	7.4000	350.1680 (30)
Rf - Flat over Bay	1.2330		1.2330	0.1700	0.2096	7.4000	9.1242 (30)
Total net area of external elements Aum(A, m ²)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2639		(33)
Party Wall			43.9660	0.0000	0.0000	7.4000	325.3484 (32)
Stud			76.2760			7.4000	564.4425 (32c)
Internal Floor			47.3200			7.4000	350.1680 (32d)
Internal Ceiling			47.3200			7.4000	350.1680 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 6200.6412 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.6776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9223 (36)
Total fabric heat loss							(33) + (36) = 80.1862 (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	47.4551	46.5037	46.1999	45.3286	45.3286	45.0515	45.0515	44.7811	44.7811	45.6124	45.6124	45.9028 (38)
Heat transfer coeff	127.6413	126.6899	126.3861	125.5149	125.5149	125.2378	125.2378	124.9674	124.9674	125.7986	125.7986	126.0890 (39)
Average = Sum(39)m / 12 =												125.8203 (39)
HLP	1.3314	1.3215	1.3183	1.3092	1.3092	1.3063	1.3063	1.3035	1.3035	1.3122	1.3122	1.3152 (40)
HLP (average)												1.3124 (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												2.6979 (42)
Average daily hot water use (litres/day)												98.2742 (43)
Daily hot water use	108.1017	104.1707	100.2397	96.3088	92.3778	88.4468	88.4468	92.3778	96.3088	100.2397	104.1707	108.1017 (44)
Energy conte	160.3117	140.2096	144.6837	126.1388	121.0332	104.4424	96.7813	111.0579	112.3843	130.9731	142.9673	155.2533 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum (45)m =	1546.2366 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.0467	21.0314	21.7026	18.9208	18.1550	15.6664	14.5172	16.6587	16.8576	19.6460	21.4451	23.2880	(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	0.6508	0.5467	0.5031	0.4157	0.3852	0.4617	0.4871	0.5892	0.6206	0.6496	(61)
Total heat required for water heating calculated for each month	160.9824	140.8183	145.3346	126.6855	121.5363	104.8581	97.1665	111.5196	112.8714	131.5622	143.5880	155.9028	(62)
WWHRS	-52.8897	-46.5364	-47.4963	-39.0773	-36.2834	-29.9315	-25.3312	-30.6705	-31.5656	-39.0222	-45.2032	-51.1206	eq. (G10)
Total of WWHRS savings												-475.1281	
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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Heat gains from water heating, kWh/month	53.4713	46.7719	48.2701	42.0778	40.3693	34.8310	32.2761	37.0422	37.4895	43.6958	47.6918	51.7841	(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	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	161.8718	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.6017	49.3850	40.1626	30.4056	22.7286	19.1884	20.7338	26.9505	36.1729	45.9299	53.6069	57.1471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.3477	376.2115	366.4749	345.7467	319.5810	294.9890	278.5601	274.6962	284.4329	305.1611	331.3267	355.9187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	53.8850	(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)	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	-107.9145	(71)
Water heating gains (Table 5)	71.8700	69.6010	64.8791	58.4414	54.2598	48.3764	43.3818	49.7879	52.0688	58.7310	66.2386	69.6023	(72)
Total internal gains	610.6618	606.0398	582.3588	545.4360	507.4117	473.3962	453.5179	462.2770	483.5170	520.6642	562.0146	593.5104	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access		Gains	
						Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
Northeast				6.0470	14.6130	0.7300		0.7200		0.7700		32.1862 (75)	
Southeast				8.3730	45.0642	0.7300		0.7200		0.7700		137.4362 (77)	
Southwest				6.1640	45.0642	0.7300		0.7200		0.7700		101.1772 (79)	
Northwest				0.8120	14.6130	0.7300		0.7200		0.7700		4.3220 (81)	

Solar gains	275.1216	409.5251	599.8636	801.0624	891.1248	998.5589	921.7506	844.1873	702.6664	503.0289	330.7105	230.0279	(83)
Total gains	885.7834	1015.5649	1182.2224	1346.4984	1398.5366	1471.9550	1375.2685	1306.4643	1186.1833	1023.6931	892.7250	823.5383	(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	13.4941	13.5954	13.6281	13.7227	13.7227	13.7530	13.7530	13.7828	13.7828	13.6917	13.6917	13.6602	
alpha	1.8996	1.9064	1.9085	1.9148	1.9148	1.9169	1.9169	1.9189	1.9189	1.9128	1.9128	1.9107	
util living area	0.8646	0.8303	0.7635	0.6621	0.5403	0.3796	0.2789	0.2835	0.4721	0.6784	0.8130	0.8758	(86)
MIT	18.4090	18.7102	19.2912	19.9496	20.4799	20.8235	20.9344	20.9347	20.7186	20.1195	19.2193	18.3723	(87)
Th 2	19.8163	19.8240	19.8265	19.8336	19.8336	19.8359	19.8359	19.8381	19.8381	19.8313	19.8313	19.8289	(88)
util rest of house	0.8488	0.8112	0.7372	0.6246	0.4859	0.3063	0.1877	0.1881	0.3955	0.6310	0.7879	0.8610	(89)
MIT 2	16.5167	16.9352	17.7356	18.6241	19.3074	19.7023	19.8059	19.8095	19.6057	18.8750	17.6606	16.4719	(90)
Living area fraction	16.8890	17.2844	18.0416	18.8849	19.5381	19.9229	20.0279	20.0309	19.8247	19.1198	17.9672	16.8458	(91)
Temperature adjustment												-0.1500	(92)
adjusted MIT	16.7390	17.1344	17.8916	18.7349	19.3881	19.7729	19.8779	19.8809	19.6747	18.9698	17.8172	16.6958	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.7921	0.7541	0.6839	0.5838	0.4630	0.3021	0.1911	0.1918	0.3838	0.5898	0.7318	0.8055	(94)
Useful gains	701.6611	765.8635	808.5498	786.1396	647.5320	444.7226	262.8286	250.5470	455.2251	603.8036	653.2940	663.3394	(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	1409.0318	1397.9474	1288.0814	1083.8049	789.2481	485.0282	272.7562	260.0386	521.6974	839.0509	1134.3515	1373.8384	(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	526.2838	424.7603	356.7715	214.3190	105.4368	0.0000	0.0000	0.0000	0.0000	175.0240	346.3614	528.6113	(98)
Space heating												2677.5681	(98)
Space heating per m2												(98) / (4) =	27.9292 (99)

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													2968.4791 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.2838	424.7603	356.7715	214.3190	105.4368	0.0000	0.0000	0.0000	0.0000	175.0240	346.3614	528.6113	(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)	583.4632	470.9095	395.5338	237.6043	116.8922	0.0000	0.0000	0.0000	0.0000	194.0399	383.9927	586.0435	(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	108.0926	94.2819	97.8383	87.6082	85.2529	74.9266	71.8353	80.8491	81.3057	92.5400	98.3847	104.7822	(64)
Efficiency of water heater (217)m	87.5068	87.3345	86.8248	85.7079	83.4602	76.4000	76.4000	76.4000	76.4000	84.8963	86.7343	76.4000	(216)
Fuel for water heating, kWh/month	123.5249	107.9549	112.6847	102.2172	102.1480	98.0714	94.0252	105.8234	106.4211	109.0035	113.4324	119.6378	(219)
Water heating fuel used												1294.9445	(219)
Annual totals kWh/year													
Space heating fuel - main system												2968.4791	(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)												392.7777	(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												2784.7553	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2968.4791	10.2300	303.6754 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1294.9445	10.2300	132.4728 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	392.7777	36.7200	144.2280 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	36.7200	-714.7349 (252)
Total energy cost			-3.8188 (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	2968.4791	0.2160	641.1915 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1294.9445	0.2160	279.7080 (264)
Space and water heating			920.8995 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.7777	0.5190	203.8516 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	0.5190	-1010.2054 (269)
Total kg/year			153.4707 (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	2968.4791	1.2200	3621.5445 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1294.9445	1.2200	1579.8323 (264)
Space and water heating			5201.3768 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	392.7777	3.0700	1205.8274 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	3.0700	-5975.5890 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Primary energy kWh/year	661.8652 (272)
Primary energy kWh/m2/year	6.9038 (273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	001 - PRJ013014			Issued on Date	30/11/2023
Assessment Reference	001	Prop Type Ref	D-SP		
Property	1 Deeble Way, Netley Abbey, Southampton, SO31 5JP				
SAP Rating	85 B	DER	14.51	TER	17.09
Environmental	88 B	% DER<TER	15.08		
CO ₂ Emissions (t/year)	1.16	DFEE	47.26	TFEE	51.09
General Requirements Compliance	Pass	% DFEE<TFEE	7.50		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.09	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.51	kgCO ₂ /m ²	Pass
	-2.58 (-15.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.09	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.26	kWh/m ² /yr	
	-3.8 (-7.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.17 (max. 0.35)	Pass
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.61 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

6.05 m², No overhang

Windows facing South East

8.37 m², No overhang

Windows facing South West

6.16 m², No overhang

Windows facing North West

0.81 m², No overhang

Air change rate

4.68 ach

Blinds/curtains

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

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.61 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K