

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-599				Issued on Date	24/09/2024
Assessment Reference	As Built	Prop Type Ref	Badlesmere-OP-SEMI			
Property	29, Goldcrest Road, Botley, Southampton, SO32 2BZ					
SAP Rating	91 B	DER	9.56	TER	18.89	
Environmental	93 A	% DER<TER	49.38			
CO ₂ Emissions (t/year)	0.46	DFEE	47.00	TFEE	54.47	
General Requirements Compliance	Pass	% DFEE<TFEE	13.70			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
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 80 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.89 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.56 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.30 (max. 2.00)	1.30 (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: 4.96 (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
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing North East: 7.51 m², No overhang
Windows facing South West: 5.06 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.037 W/m²K
Photovoltaic array 1.48 kW

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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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.4420 (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) =	0.4088 (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	0.5212	0.5110	0.5008	0.4497	0.4395	0.3884	0.3884	0.3781	0.4088	0.4395	0.4599	0.4804 (22b)
Effective ac	0.6358	0.6306	0.6254	0.6011	0.5966	0.5754	0.5754	0.5715	0.5836	0.5966	0.6058	0.6154 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (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	43.2731	42.9141	42.5622	40.9094	40.6002	39.1607	39.1607	38.8941	39.7151	40.6002	41.2258	41.8798 (38)
Heat transfer coeff	99.1547	98.7957	98.4438	96.7910	96.4818	95.0423	95.0423	94.7757	95.5968	96.4818	97.1074	97.7614 (39)
Average = Sum(39)m / 12 =												96.7896 (39)
HLP	1.2429	1.2384	1.2339	1.2132	1.2093	1.1913	1.1913	1.1880	1.1983	1.2093	1.2172	1.2254 (40)
HLP (average)												1.2132 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418	(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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076	(61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
												Total per year (kWh/year) = Sum (64)m =	1622.0849 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646	(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	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	374.3177	372.1854	358.6535	336.8644	314.7557	293.4745	279.6753	285.6863	296.9071	318.9077	344.1597	363.0836	(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					3.0000	11.2829	0.4600		0.0000	0.7700		11.9893 (75)
Southwest					5.0600	36.7938	0.4600		0.0000	0.7700		65.9438 (79)
Northwest					0.7200	11.2829	0.4600		0.0000	0.7700		2.8774 (81)
Northeast					4.5100	11.2829	0.4600		0.0000	0.7700		18.0238 (75)

Solar gains	98.8343	179.2763	274.3122	388.5255	479.5768	495.6370	469.7202	398.8064	313.3938	205.9627	120.3703	83.2942 (83)
Total gains	473.1520	551.4617	632.9657	725.3900	794.3325	789.1115	749.3955	684.4926	610.3009	524.8704	464.5299	446.3778 (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	33.7119	33.8344	33.9553	34.5351	34.6458	35.1706	35.1706	35.2695	34.9666	34.6458	34.4226	34.1924	
alpha	3.2475	3.2556	3.2637	3.3023	3.3097	3.3447	3.3447	3.3513	3.3311	3.3097	3.2948	3.2795	
util living area	0.9877	0.9790	0.9596	0.9103	0.8124	0.6616	0.5200	0.5776	0.7980	0.9405	0.9803	0.9898	(86)
MIT	19.0107	19.2393	19.6243	20.1384	20.5746	20.8538	20.9516	20.9311	20.7078	20.1393	19.4930	18.9815	(87)
Th 2	19.8859	19.8894	19.8929	19.9094	19.9125	19.9270	19.9270	19.9296	19.9214	19.9125	19.9063	19.8997	(88)
util rest of house	0.9850	0.9744	0.9504	0.8892	0.7670	0.5806	0.4080	0.4650	0.7324	0.9221	0.9752	0.9876	(89)
MIT 2	17.2400	17.5738	18.1316	18.8703	19.4598	19.8074	19.9010	19.8892	19.6498	18.8876	17.9553	17.2058	(90)
Living area fraction	17.6058	17.9178	18.4399	19.1323	19.6900	20.0236	20.1180	20.1044	19.8684	19.1461	18.2729	17.5726	(91)
MIT	17.6058	17.9178	18.4399	19.1323	19.6900	20.0236	20.1180	20.1044	19.8684	19.1461	18.2729	17.5726	(92)
Temperature adjustment	17.4558	17.7678	18.2899	18.9823	19.5400	19.8736	19.9680	19.9544	19.7184	18.9961	18.1229	17.4226	(93)
adjusted MIT	17.4558	17.7678	18.2899	18.9823	19.5400	19.8736	19.9680	19.9544	19.7184	18.9961	18.1229	17.4226	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9760	0.9616	0.9320	0.8663	0.7488	0.5762	0.4126	0.4678	0.7178	0.9010	0.9628	0.9798	(94)
Useful gains	461.8033	530.2687	589.9428	628.4130	594.8340	454.6615	309.1746	320.2156	438.0610	472.9238	447.2492	437.3425	(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	1304.4564	1271.2872	1160.6433	975.8744	756.4215	501.2105	320.1055	336.8753	537.0993	810.0753	1070.4097	1292.6558	(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	626.9339	497.9644	424.6012	250.1722	120.2211	0.0000	0.0000	0.0000	0.0000	250.8408	448.6756	636.3530	(98)
Space heating												3255.7622	(98)
Space heating per m2												(98) / (4) =	40.8093 (99)

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3597.5273 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.9339	497.9644	424.6012	250.1722	120.2211	0.0000	0.0000	0.0000	0.0000	250.8408	448.6756	636.3530	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	692.7446	550.2369	469.1726	276.4334	132.8410	0.0000	0.0000	0.0000	0.0000	277.1721	495.7741	703.1525	(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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater (217)m	89.8135	89.7586	89.6406	89.3662	88.8209	87.3000	87.3000	87.3000	87.3000	89.3408	89.6832	87.3000	(216)
Fuel for water heating, kWh/month	183.8964	161.3674	167.7653	148.1756	144.1458	128.1956	120.4190	135.8687	136.8056	153.8361	165.3968	178.5303	(219)
Water heating fuel used												1824.4027	(219)
Annual totals kWh/year													
Space heating fuel - main system												3597.5273	(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)												356.9126	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												4635.2855	(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	3597.5273	0.2160	777.0659	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1824.4027	0.2160	394.0710	(264)
Space and water heating			1171.1369	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				
PV Unit	-1218.5571	0.5190	-632.4311	(269)
Total CO2, kg/year			762.8684	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5600	(273)

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

DER			9.5600	ZC1
Total Floor Area		TFA	79.7800	
Assumed number of occupants		N	2.4587	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.2651	ZC2
CO2 emissions from cooking, equation (L16)			2.2312	ZC3
Total CO2 emissions			28.0563	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			28.0563	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1455 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3955 (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) =					0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298	(22b)				
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			13.2900	1.3258	17.6193		(27)					
GF B&B J150 P/A=0.40			39.8900	0.1300	5.1857		(28a)					
EW Brick AAC015	92.3400	15.4200	76.9200	0.1800	13.8456		(29a)					
Plane Ceiling	39.8900		39.8900	0.1300	5.1857		(30)					
Total net area of external elements Aum(A, m2)			172.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.9663		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2689 (36)					
Total fabric heat loss						(33) + (36) =	53.2352 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.4304	Feb 41.1430	Mar 40.8612	Apr 39.5379	May 39.2903	Jun 38.1377	Jul 38.1377	Aug 37.9242	Sep 38.5817	Oct 39.2903	Nov 39.7912	Dec 40.3148 (38)
Heat transfer coeff	94.6656	94.3782	94.0965	92.7731	92.5255	91.3729	91.3729	91.1595	91.8169	92.5255	93.0264	93.5500 (39)
Average = Sum(39)m / 12 =												92.7719 (39)
HLP	Jan 1.1866	Feb 1.1830	Mar 1.1794	Apr 1.1629	May 1.1598	Jun 1.1453	Jul 1.1453	Aug 1.1426	Sep 1.1509	Oct 1.1598	Nov 1.1660	Dec 1.1726 (40)
HLP (average)												1.1628 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan 101.8528	Feb 98.1491	Mar 94.4454	Apr 90.7416	May 87.0379	Jun 83.3341	Jul 83.3341	Aug 87.0379	Sep 90.7416	Oct 94.4454	Nov 98.1491	Dec 101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)
Energy content (annual)										Total = Sum(45)m =		1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	45.1755	48.1283	44.7493	44.3536	41.0963	42.4662	44.3536	44.7493	48.1283	48.4023	50.9589 (61)
Solar input	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (64)
	62.9621	55.2187	57.3586	50.7041	49.0056	42.9938	40.9362	45.8806	46.3951	53.0633	56.8894	61.3774 (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	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	84.6265	82.1707	77.0949	70.4223	65.8678	59.7136	55.0217	61.6675	64.4376	71.3216	79.0130	82.4966	(72)
Total internal gains	386.6966	384.2535	370.0993	347.6900	324.9569	303.0532	289.2610	295.8941	307.7425	330.3634	356.2333	375.4664	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.5100	11.2829	0.6300	0.7000	0.7700	25.8961 (75)			
Southwest				5.0600	36.7938	0.6300	0.7000	0.7700	56.8980 (79)			
Northwest				0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (81)			
Solar gains	85.2768	154.6843	236.6837	335.2300	413.7914	427.6485	405.2868	344.1005	270.4043	177.7100	103.8586	71.8684 (83)
Total gains	471.9735	538.9378	606.7831	682.9200	738.7483	730.7017	694.5479	639.9946	578.1468	508.0733	460.0920	447.3348 (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	58.5247	58.7029	58.8787	59.7186	59.8784	60.6337	60.6337	60.7757	60.3405	59.8784	59.5560	59.2226	
alpha	4.9016	4.9135	4.9252	4.9812	4.9919	5.0422	5.0422	5.0517	5.0227	4.9919	4.9704	4.9482	
util living area	0.9981	0.9960	0.9897	0.9653	0.8897	0.7300	0.5628	0.6263	0.8697	0.9801	0.9962	0.9986	(86)
MIT	19.7022	19.8501	20.1056	20.4558	20.7612	20.9395	20.9868	20.9782	20.8461	20.4544	20.0202	19.6812	(87)
Th 2	19.9307	19.9336	19.9365	19.9498	19.9523	19.9640	19.9640	19.9662	19.9595	19.9523	19.9473	19.9420	(88)
util rest of house	0.9975	0.9947	0.9858	0.9516	0.8466	0.6384	0.4385	0.4997	0.8026	0.9698	0.9946	0.9981	(89)
MIT 2	18.2027	18.4206	18.7941	19.3043	19.7145	19.9232	19.9591	19.9570	19.8319	19.3111	18.6794	18.1799	(90)
Living area fraction	18.5125	18.7159	19.0650	19.5422	19.9307	20.1331	20.1714	20.1679	20.0414	19.5472	18.9564	18.4900	(91)
MIT	18.5125	18.7159	19.0650	19.5422	19.9307	20.1331	20.1714	20.1679	20.0414	19.5472	18.9564	18.4900	(92)
Temperature adjustment	18.5125	18.7159	19.0650	19.5422	19.9307	20.1331	20.1714	20.1679	20.0414	19.5472	18.9564	18.4900	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9923	0.9814	0.9448	0.8455	0.6546	0.4643	0.5257	0.8088	0.9643	0.9924	0.9970	(94)
Useful gains	470.1654	534.7988	595.5126	645.1906	624.6205	478.3121	322.4530	336.4589	467.6264	489.9447	456.5970	446.0112	(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	1345.4328	1303.9224	1182.3200	987.3094	761.5543	505.5763	326.3303	343.4833	545.5241	827.8482	1102.9541	1336.8330	(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	651.1990	516.8511	436.5847	246.3255	101.8788	0.0000	0.0000	0.0000	0.0000	251.4002	465.3771	662.7714	(98)
Space heating												3332.3877	(98)
Space heating per m2												41.7697	(99)

8c. Space cooling requirement

Not applicable

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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													3567.8670 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	651.1990	516.8511	436.5847	246.3255	101.8788	0.0000	0.0000	0.0000	0.0000	251.4002	465.3771	662.7714	(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)	697.2152	553.3738	467.4354	263.7318	109.0779	0.0000	0.0000	0.0000	0.0000	269.1651	498.2624	709.6054	(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	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378	(64)
Efficiency of water heater (217)m	87.7858	87.5864	87.1446	86.0791	83.9724	80.3000	80.3000	80.3000	80.3000	86.0123	87.2996	80.3000	(216)
Fuel for water heating, kWh/month	230.1098	202.4061	211.6582	190.0539	188.6220	173.7253	166.4421	185.5439	187.5930	199.4256	209.7437	224.4772	(219)
Water heating fuel used												2369.8007	(219)
Annual totals kWh/year													
Space heating fuel - main system												3567.8670	(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)												356.9126	(232)
Total delivered energy for all uses												6369.5804	(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	3567.8670	0.2160	770.6593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2369.8007	0.2160	511.8770 (264)
Space and water heating			1282.5362 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total CO2, kg/m2/year			1506.6989 (272)
Emissions per m2 for space and water heating			16.0759 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3219 (272b)
Emissions per m2 for pumps and fans			0.4879 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0759 * 1.00) + 2.3219 + 0.4879, rounded to 2 d.p.			18.8900 (273)

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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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1455 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.3935 (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) =	0.3640 (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	0.4640	0.4549	0.4458	0.4004	0.3913	0.3458	0.3458	0.3367	0.3640	0.3913	0.4095	0.4277 (22b)
Effective ac	0.6077	0.6035	0.5994	0.5801	0.5765	0.5598	0.5598	0.5567	0.5662	0.5765	0.5838	0.5914 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (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	41.3557	41.0712	40.7923	39.4823	39.2372	38.0962	38.0962	37.8849	38.5357	39.2372	39.7330	40.2514 (38)
Heat transfer coeff	97.2374	96.9528	96.6739	95.3639	95.1188	93.9779	93.9779	93.7666	94.4173	95.1188	95.6147	96.1330 (39)
Average = Sum(39)m / 12 =												95.3628 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2188	1.2153	1.2118	1.1953	1.1923	1.1780	1.1780	1.1753	1.1835	1.1923	1.1985	1.2050 (40)
HLP (average)												1.1953 (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	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 = 1456.8563 (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	32.0970	28.0723	28.9681	25.2551	24.2328	20.9111	19.3772	22.2356	22.5012	26.2230	28.6244	31.0843 (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	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	43.1412	41.7742	38.9356	35.0765	32.5710	29.0432	26.0446	29.8866	31.2516	35.2459	39.7561	41.7799	(72)
Total internal gains	342.2113	340.8570	328.9400	309.3442	288.6601	269.3828	257.2839	261.1132	271.5566	291.2876	313.9765	331.7497	(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					3.0000	11.2829	0.4600	0.0000			0.7700			11.9893 (75)
Southwest					5.0600	36.7938	0.4600	0.0000			0.7700			65.9438 (79)
Northwest					0.7200	11.2829	0.4600	0.0000			0.7700			2.8774 (81)
Northeast					4.5100	11.2829	0.4600	0.0000			0.7700			18.0238 (75)
Solar gains	98.8343	179.2763	274.3122	388.5255	479.5768	495.6370	469.7202	398.8064	313.3938	205.9627	120.3703	83.2942	(83)	
Total gains	441.0456	520.1333	603.2523	697.8697	768.2369	765.0198	727.0041	659.9196	584.9504	497.2503	434.3467	415.0440	(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	34.3766	34.4775	34.5770	35.0520	35.1423	35.5689	35.5689	35.6491	35.4034	35.1423	34.9600	34.7715	
alpha	3.2918	3.2985	3.3051	3.3368	3.3428	3.3713	3.3713	3.3766	3.3602	3.3428	3.3307	3.3181	
util living area	0.9900	0.9821	0.9639	0.9168	0.8208	0.6714	0.5288	0.5898	0.8103	0.9475	0.9836	0.9918	(86)
MIT	19.0005	19.2297	19.6160	20.1288	20.5691	20.8505	20.9505	20.9283	20.6983	20.1213	19.4731	18.9659	(87)
Th 2	19.9050	19.9078	19.9106	19.9237	19.9262	19.9377	19.9377	19.9398	19.9332	19.9262	19.9212	19.9160	(88)
util rest of house	0.9878	0.9781	0.9557	0.8969	0.7767	0.5911	0.4167	0.4771	0.7469	0.9309	0.9794	0.9900	(89)
MIT 2	18.0831	18.3126	18.6959	19.2029	19.6112	19.8535	19.9194	19.9108	19.7397	19.2068	18.5658	18.0568	(90)
Living area fraction	18.2726	18.5021	18.8859	19.3942	19.8091	20.0594	20.1324	20.1210	19.9377	19.3957	18.7532	18.2446	(92)
Temperature adjustment	18.2726	18.5021	18.8859	19.3942	19.8091	20.0594	20.1324	20.1210	19.9377	19.3957	18.7532	18.2446	(93)
adjusted MIT	18.2726	18.5021	18.8859	19.3942	19.8091	20.0594	20.1324	20.1210	19.9377	19.3957	18.7532	18.2446	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	433.6484	505.2203	570.4882	617.6299	592.5230	459.8376	318.6957	328.5334	437.0924	457.6895	422.6515	409.2707	(94)
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	1358.6621	1318.7583	1197.3972	1000.7686	771.3251	513.0669	331.9637	348.9010	551.1826	836.6381	1114.2212	1350.1499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	688.2102	546.6975	466.4203	275.8598	133.0288	0.0000	0.0000	0.0000	0.0000	281.9378	497.9302	700.0141	(98)
Space heating												3590.0987	(98)
Space heating per m2												45.0000	(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													

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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	883.3919	695.4362	712.6259	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8117	0.8713	0.8391	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	717.0270	605.9145	597.9806	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	986.1124	939.8049	863.0181	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	193.7416	248.4145	197.1879	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			639.3439 (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	48.4354	62.1036	49.2970	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												159.8360 (107)
Energy for space heating												2.0035 (108)
Energy for space cooling												45.0000 (99)
Total												2.0035 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.0034 (109)
												47.0 (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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1455 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3955 (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) =							0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298	(22b)				
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			13.2900	1.3258	17.6193		(27)					
GF B&B J150 P/A=0.40			39.8900	0.1300	5.1857		(28a)					
EW Brick AAC015	92.3400	15.4200	76.9200	0.1800	13.8456		(29a)					
Plane Ceiling	39.8900		39.8900	0.1300	5.1857		(30)					
Total net area of external elements Aum(A, m2)			172.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.9663		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2689 (36)					
Total fabric heat loss						(33) + (36) =	53.2352 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.4304	Feb 41.1430	Mar 40.8612	Apr 39.5379	May 39.2903	Jun 38.1377	Jul 38.1377	Aug 37.9242	Sep 38.5817	Oct 39.2903	Nov 39.7912	Dec 40.3148 (38)
Heat transfer coeff	94.6656	94.3782	94.0965	92.7731	92.5255	91.3729	91.3729	91.1595	91.8169	92.5255	93.0264	93.5500 (39)
Average = Sum(39)m / 12 =												92.7719 (39)
HLP	Jan 1.1866	Feb 1.1830	Mar 1.1794	Apr 1.1629	May 1.1598	Jun 1.1453	Jul 1.1453	Aug 1.1426	Sep 1.1509	Oct 1.1598	Nov 1.1660	Dec 1.1726 (40)
HLP (average)												1.1628 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)
Energy content (annual)										Total = Sum(45)m =	1456.8563 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
	32.0970	28.0723	28.9681	25.2551	24.2328	20.9111	19.3772	22.2356	22.5012	26.2230	28.6244	31.0843 (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	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934 (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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469 (71)
Water heating gains (Table 5)	43.1412	41.7742	38.9356	35.0765	32.5710	29.0432	26.0446	29.8866	31.2516	35.2459	39.7561	41.7799 (72)
Total internal gains	342.2113	340.8570	328.9400	309.3442	288.6601	269.3828	257.2839	261.1132	271.5566	291.2876	313.9765	331.7497 (73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
Northeast					7.5100	11.2829	0.6300	0.7000	0.7700			25.8961 (75)
Southwest					5.0600	36.7938	0.6300	0.7000	0.7700			56.8980 (79)
Northwest					0.7200	11.2829	0.6300	0.7000	0.7700			2.4827 (81)

Solar gains	85.2768	154.6843	236.6837	335.2300	413.7914	427.6485	405.2868	344.1005	270.4043	177.7100	103.8586	71.8684 (83)
Total gains	427.4881	495.5413	565.6238	644.5741	702.4515	697.0313	662.5708	605.2137	541.9609	468.9976	417.8351	403.6182 (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 (see Table 9a)												
tau	58.5247	58.7029	58.8787	59.7186	59.8784	60.6337	60.6337	60.7757	60.3405	59.8784	59.5560	59.2226
alpha	4.9016	4.9135	4.9252	4.9812	4.9919	5.0422	5.0422	5.0517	5.0227	4.9919	4.9704	4.9482
util living area	0.9988	0.9973	0.9923	0.9721	0.9052	0.7537	0.5866	0.6555	0.8917	0.9856	0.9975	0.9991 (86)
MIT	19.6506	19.8002	20.0596	20.4175	20.7360	20.9300	20.9842	20.9733	20.8232	20.4124	19.9715	19.6302 (87)
Th 2	19.9307	19.9336	19.9365	19.9498	19.9523	19.9640	19.9640	19.9662	19.9595	19.9523	19.9473	19.9420 (88)
util rest of house	0.9984	0.9963	0.9894	0.9607	0.8658	0.6630	0.4587	0.5261	0.8309	0.9779	0.9965	0.9988 (89)
MIT 2	18.6995	18.8511	19.1113	19.4732	19.7698	19.9310	19.9599	19.9583	19.8563	19.4744	19.0332	18.6881 (90)
Living area fraction									fLA = Living area / (4) =			0.2066 (91)
MIT	18.8960	19.0471	19.3072	19.6683	19.9694	20.1374	20.1715	20.1680	20.0560	19.6682	19.2270	18.8827 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8960	19.0471	19.3072	19.6683	19.9694	20.1374	20.1715	20.1680	20.0560	19.6682	19.2270	18.8827 (93)

8. Space heating requirement

Utilisation	0.9978	0.9952	0.9871	0.9569	0.8666	0.6797	0.4854	0.5530	0.8377	0.9751	0.9955	0.9984 (94)
Useful gains	426.5480	493.1436	558.3069	616.7684	608.7375	473.7413	321.6152	334.7070	453.9968	457.2987	415.9417	402.9524 (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	1381.7359	1335.1815	1205.1141	999.0044	765.1287	505.9680	326.3394	343.4863	546.8623	839.0388	1128.1314	1373.5691 (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	710.6598	565.8495	481.2246	275.2099	116.3550	0.0000	0.0000	0.0000	0.0000	284.0147	512.7766	722.1388 (98)
Space heating												3668.2289 (98)
Space heating per m2										(98) / (4) =		45.9793 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	858.9053	676.1595	692.8119	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8562	0.9184	0.8882	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	735.4125	620.9862	615.3373	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	906.6454	864.4932	799.0762	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	123.2877	181.1691	136.7017	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												441.1586 (104)

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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	30.8219	45.2923	34.1754	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												110.2896 (107)
Space cooling per m2												1.3824 (108)
Energy for space heating												45.9793 (99)
Energy for space cooling												1.3824 (108)
Total												47.3617 (109)
Target Fabric Energy Efficiency (TFEE)												54.5 (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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.4420 (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)	=	0.4088 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.4293	0.3986	0.4088	0.3884	0.3884	0.3781	0.3679	0.3577	0.3475	0.3781	0.3577	0.3781 (22b)
Effective ac	0.5921	0.5794	0.5836	0.5754	0.5754	0.5715	0.5677	0.5640	0.5604	0.5715	0.5640	0.5715 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (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	40.2981	39.4344	39.7151	39.1607	39.1607	38.8941	38.6346	38.3823	38.1370	38.8941	38.3823	38.8941 (38)
Heat transfer coeff	96.1797	95.3160	95.5968	95.0423	95.0423	94.7757	94.5163	94.2639	94.0186	94.7757	94.2639	94.7757 (39)
Average = Sum(39)m / 12 =												94.8806 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2056	1.1947	1.1983	1.1913	1.1913	1.1880	1.1847	1.1815	1.1785	1.1880	1.1815	1.1880 (40)
HLP (average)												1.1893 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)	
	Total per year (kWh/year) = Sum(64)m = 1622.0849 (64)												
RHI water heating demand	1622 (64)												
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (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	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(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				3.0000	14.6176		0.4600		0.0000		0.7700		15.5327 (75)
Southwest				5.0600	45.1778		0.4600		0.0000		0.7700		80.9700 (79)
Northwest				0.7200	14.6176		0.4600		0.0000		0.7700		3.7279 (81)
Northeast				4.5100	14.6176		0.4600		0.0000		0.7700		23.3508 (75)
Solar gains	123.5815	191.6670	297.7436	426.8829	501.9417	563.6258	529.9494	460.5125	360.2735	238.1996	150.2084	102.2626	(83)
Total gains	677.5739	741.2570	825.9531	921.9795	963.1646	994.5140	943.1220	881.9664	800.7968	712.0473	661.0730	641.1046	(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	34.7547	35.0696	34.9666	35.1706	35.1706	35.2695	35.3663	35.4610	35.5535	35.2695	35.4610	35.2695
alpha	3.3170	3.3380	3.3311	3.3447	3.3447	3.3513	3.3578	3.3641	3.3702	3.3513	3.3641	3.3513
util living area	0.9627	0.9492	0.9125	0.8305	0.6981	0.5087	0.3805	0.4037	0.6445	0.8542	0.9392	0.9670 (86)
MIT	19.4854	19.6563	20.0100	20.4448	20.7703	20.9417	20.9834	20.9804	20.8703	20.4879	19.9558	19.4779 (87)
Th 2	19.9156	19.9242	19.9214	19.9270	19.9270	19.9296	19.9323	19.9348	19.9373	19.9296	19.9348	19.9296 (88)
util rest of house	0.9552	0.9392	0.8949	0.7968	0.6394	0.4248	0.2809	0.2992	0.5627	0.8164	0.9251	0.9602 (89)
MIT 2	17.9427	18.1922	18.6911	19.2900	19.7033	19.8892	19.9253	19.9264	19.8330	19.3650	18.6323	17.9418 (90)
Living area fraction	18.2614	18.4946	18.9635	19.5286	19.9237	20.1066	20.1439	20.1441	20.0473	19.5969	18.9057	18.2591 (91)
MIT	18.2614	18.4946	18.9635	19.5286	19.9237	20.1066	20.1439	20.1441	20.0473	19.5969	18.9057	18.2591 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1114	18.3446	18.8135	19.3786	19.7737	19.9566	19.9939	19.9941	19.8973	19.4469	18.7557	18.1091 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9379	0.9196	0.8723	0.7768	0.6302	0.4271	0.2868	0.3052	0.5593	0.7959	0.9044	0.9442	(94)
Useful gains	635.4985	681.6833	720.4894	716.1720	606.9973	424.7240	270.4604	269.1502	447.8943	566.7043	597.8709	605.3021	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1270.6691	1243.3618	1129.3351	938.8802	691.3114	441.3348	273.5162	272.8099	488.6418	762.6553	1023.2979	1242.4267	(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	472.5669	377.4480	304.1812	160.3499	62.7296	0.0000	0.0000	0.0000	0.0000	145.7875	306.3075	474.0207	(98)
Space heating												2303.3914	(98)
RHI space heating demand												2303	(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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.4420 (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)	=	0.4088 (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	0.5212	0.5110	0.5008	0.4497	0.4395	0.3884	0.3884	0.3781	0.4088	0.4395	0.4599	0.4804 (22b)
Effective ac	0.6358	0.6306	0.6254	0.6011	0.5966	0.5754	0.5754	0.5715	0.5836	0.5966	0.6058	0.6154 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (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	43.2731	42.9141	42.5622	40.9094	40.6002	39.1607	39.1607	38.8941	39.7151	40.6002	41.2258	41.8798 (38)
Heat transfer coeff	99.1547	98.7957	98.4438	96.7910	96.4818	95.0423	95.0423	94.7757	95.5968	96.4818	97.1074	97.7614 (39)
Average = Sum(39)m / 12 =												96.7896 (39)
HLP	1.2429	1.2384	1.2339	1.2132	1.2093	1.1913	1.1913	1.1880	1.1983	1.2093	1.2172	1.2254 (40)
HLP (average)												1.2132 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Output from w/h	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	Solar input (sum of months) = Sum(63)m =		0.0000 (63)			
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	
	Total per year (kWh/year) = Sum(64)m =											1622.0849 (64)	

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	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(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					3.0000	11.2829	0.4600	0.0000	0.7700			11.9893 (75)
Southwest					5.0600	36.7938	0.4600	0.0000	0.7700			65.9438 (79)
Northwest					0.7200	11.2829	0.4600	0.0000	0.7700			2.8774 (81)
Northeast					4.5100	11.2829	0.4600	0.0000	0.7700			18.0238 (75)

Solar gains	98.8343	179.2763	274.3122	388.5255	479.5768	495.6370	469.7202	398.8064	313.3938	205.9627	120.3703	83.2942 (83)
Total gains	652.8268	728.8662	802.5217	883.6221	940.7997	926.5252	882.8928	820.2602	753.9171	679.8104	631.2348	622.1362 (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	33.7119	33.8344	33.9553	34.5351	34.6458	35.1706	35.1706	35.2695	34.9666	34.6458	34.4226	34.1924
alpha	3.2475	3.2556	3.2637	3.3023	3.3097	3.3447	3.3447	3.3513	3.3311	3.3097	3.2948	3.2795
util living area	0.9699	0.9557	0.9269	0.8621	0.7495	0.5907	0.4523	0.4995	0.7153	0.8907	0.9548	0.9738 (86)
MIT	19.2883	19.5019	19.8532	20.3095	20.6755	20.8966	20.9681	20.9555	20.7963	20.3282	19.7412	19.2573 (87)
Th 2	19.8859	19.8894	19.8929	19.9094	19.9125	19.9270	19.9270	19.9296	19.9214	19.9125	19.9063	19.8997 (88)
util rest of house	0.9639	0.9469	0.9120	0.8337	0.6983	0.5110	0.3506	0.3956	0.6420	0.8617	0.9442	0.9686 (89)
MIT 2	17.6400	17.9488	18.4517	19.0968	19.5776	19.8455	19.9105	19.9048	19.7417	19.1394	18.3083	17.6041 (90)
Living area fraction	17.9805	18.2696	18.7412	19.3473	19.8044	20.0626	20.1290	20.1218	19.9595	19.3849	18.6043	17.9456 (91)
MIT	17.9805	18.2696	18.7412	19.3473	19.8044	20.0626	20.1290	20.1218	19.9595	19.3849	18.6043	17.9456 (92)
Temperature adjustment	17.8305	18.1196	18.5912	19.1973	19.6544	19.9126	19.9790	19.9718	19.8095	19.2349	18.4543	17.7956 (93)
adjusted MIT	17.8305	18.1196	18.5912	19.1973	19.6544	19.9126	19.9790	19.9718	19.8095	19.2349	18.4543	17.7956 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9481	0.9278	0.8894	0.8115	0.6846	0.5099	0.3558	0.3999	0.6335	0.8392	0.9251	0.9541	(94)
Ext temp.	618.9251	676.2382	713.7781	717.0375	644.1053	472.4340	314.1194	328.0568	477.6059	570.4843	583.9691	593.5767	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1341.6128	1306.0397	1190.3056	996.6874	767.4559	504.9234	321.1456	338.5195	545.8138	833.1136	1102.5822	1329.1209	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	537.6797	423.2266	354.5365	201.3479	91.7729	0.0000	0.0000	0.0000	0.0000	195.3962	373.4015	547.2449	(98)
Space heating per m2	(98) / (4) = 34.1515 (99)												

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3010.6145 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.6797	423.2266	354.5365	201.3479	91.7729	0.0000	0.0000	0.0000	0.0000	195.3962	373.4015	547.2449	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	594.1212	467.6537	391.7531	222.4839	101.4065	0.0000	0.0000	0.0000	0.0000	215.9074	412.5983	604.6905	(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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater (217)m	89.7271	89.6620	89.5226	89.2028	88.6081	87.3000	87.3000	87.3000	87.3000	89.1506	89.5666	87.3000	(216)
Fuel for water heating, kWh/month	184.0736	161.5414	167.9864	148.4472	144.4919	128.1956	120.4190	135.8687	136.8056	154.1643	165.6122	178.6950	(219)
Water heating fuel used												1826.3008	(219)
Annual totals kWh/year													
Space heating fuel - main system												3010.6145	(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)												356.9126	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												4050.2709	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3010.6145	3.4800	104.7694	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1826.3008	3.4800	63.5553	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	356.9126	13.1900	47.0768	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1218.5571	13.1900	-160.7277	(252)
Total energy cost			184.5663	(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] =	0.6212 (257)
SAP value	91.3338	
SAP rating (Section 12)	91	(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	3010.6145	0.2160	650.2927	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1826.3008	0.2160	394.4810	(264)
Space and water heating			1044.7737	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				
PV Unit	-1218.5571	0.5190	-632.4311	(269)
Total kg/year			636.5052	(272)
CO2 emissions per m2			7.9800	(273)
EI value			93.1646	
EI rating			93	(274)
EI band			A	

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Calculation of stars for heating and DHW	
Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8870 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, stars = 4

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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.4420 (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)	=	0.4088 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.4293	0.3986	0.4088	0.3884	0.3884	0.3781	0.3679	0.3577	0.3475	0.3781	0.3577	0.3781 (22b)
Effective ac	0.5921	0.5794	0.5836	0.5754	0.5754	0.5715	0.5677	0.5640	0.5604	0.5715	0.5640	0.5715 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.2981	39.4344	39.7151	39.1607	39.1607	38.8941	38.6346	38.3823	38.1370	38.8941	38.3823	38.8941 (38)
Average = Sum(39)m / 12 =	96.1797	95.3160	95.5968	95.0423	95.0423	94.7757	94.5163	94.2639	94.0186	94.7757	94.2639	94.7757 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2056	1.1947	1.1983	1.1913	1.1913	1.1880	1.1847	1.1815	1.1785	1.1880	1.1815	1.1880 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

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Energy content (annual)												Total = Sum(45)m = 1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)
	Total per year (kWh/year) = Sum(64)m = 1622.0849 (64)											
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (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	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(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					3.0000	14.6176	0.4600	0.0000	0.7700		15.5327 (75)	
Southwest					5.0600	45.1778	0.4600	0.0000	0.7700		80.9700 (79)	
Northwest					0.7200	14.6176	0.4600	0.0000	0.7700		3.7279 (81)	
Northeast					4.5100	14.6176	0.4600	0.0000	0.7700		23.3508 (75)	
Solar gains	123.5815	191.6670	297.7436	426.8829	501.9417	563.6258	529.9494	460.5125	360.2735	238.1996	150.2084	102.2626 (83)
Total gains	677.5739	741.2570	825.9531	921.9795	963.1646	994.5140	943.1220	881.9664	800.7968	712.0473	661.0730	641.1046 (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	34.7547	35.0696	34.9666	35.1706	35.1706	35.2695	35.3663	35.4610	35.5535	35.2695	35.4610	35.2695
alpha	3.3170	3.3380	3.3311	3.3447	3.3447	3.3513	3.3578	3.3641	3.3702	3.3513	3.3641	3.3513
util living area	0.9627	0.9492	0.9125	0.8305	0.6981	0.5087	0.3805	0.4037	0.6445	0.8542	0.9392	0.9670 (86)
MIT	19.4854	19.6563	20.0100	20.4448	20.7703	20.9417	20.9834	20.9804	20.8703	20.4879	19.9558	19.4779 (87)
Th 2	19.9156	19.9242	19.9214	19.9270	19.9270	19.9296	19.9323	19.9348	19.9373	19.9296	19.9348	19.9296 (88)
util rest of house	0.9552	0.9392	0.8949	0.7968	0.6394	0.4248	0.2809	0.2992	0.5627	0.8164	0.9251	0.9602 (89)
MIT 2	17.9427	18.1922	18.6911	19.2900	19.7033	19.8892	19.9253	19.9264	19.8330	19.3650	18.6323	17.9418 (90)
Living area fraction	fLA = Living area / (4) = 0.2066 (91)											
MIT	18.2614	18.4946	18.9635	19.5286	19.9237	20.1066	20.1439	20.1441	20.0473	19.5969	18.9057	18.2591 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.1114	18.3446	18.8135	19.3786	19.7737	19.9566	19.9939	19.9941	19.8973	19.4469	18.7557	18.1091 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9379	0.9196	0.8723	0.7768	0.6302	0.4271	0.2868	0.3052	0.5593	0.7959	0.9044	0.9442	(94)
Useful gains	635.4985	681.6833	720.4894	716.1720	606.9973	424.7240	270.4604	269.1502	447.8943	566.7043	597.8709	605.3021	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1270.6691	1243.3618	1129.3351	938.8802	691.3114	441.3348	273.5162	272.8099	488.6418	762.6553	1023.2979	1242.4267	(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	472.5669	377.4480	304.1812	160.3499	62.7296	0.0000	0.0000	0.0000	0.0000	145.7875	306.3075	474.0207	(98)
Space heating												2303.3914	(98)
Space heating per m2												(98) / (4) = 28.8718	(99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2545.1839	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	472.5669	377.4480	304.1812	160.3499	62.7296	0.0000	0.0000	0.0000	0.0000	145.7875	306.3075	474.0207	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	522.1734	417.0696	336.1119	177.1822	69.3145	0.0000	0.0000	0.0000	0.0000	161.0912	338.4613	523.7798	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)	
Efficiency of water heater (217)m	89.6489	89.5893	89.4157	89.0241	88.3270	87.3000	87.3000	87.3000	87.3000	88.9184	89.4305	87.3000	(216)	
Fuel for water heating, kWh/month	184.2341	161.6725	168.1873	148.7451	144.9518	128.1956	120.4190	135.8687	136.8056	154.5670	165.8643	178.8649	(219)	
Water heating fuel used												1828.3759	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2545.1839	(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)												356.9126	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =										-1368.9771		-1368.9771	(233)	
Total delivered energy for all uses												3436.4952	(238)	

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2545.1839	7.3800	187.8346	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1828.3759	7.3800	134.9341	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	356.9126	28.6600	102.2912	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1368.9771	28.6600	-392.3488	(252)
Total energy cost			161.2060	(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	2545.1839	0.2160	549.7597	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1828.3759	0.2160	394.9292	(264)
Space and water heating			944.6889	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				
PV Unit	-1368.9771	0.5190	-710.4991	(269)
Total kg/year			458.3524	(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	2545.1839	1.2200	3105.1243	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1828.3759	1.2200	2230.6185	(264)
Space and water heating			5335.7428	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	356.9126	3.0700	1095.7218	(268)
Energy saving/generation technologies				
PV Unit	-1368.9771	3.0700	-4202.7598	(269)
Primary energy kWh/year			2458.9549	(272)
Primary energy kWh/m2/year			30.8217	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 91
Current environmental impact rating: A 93

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
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
N Solar water heating	+ 1.2	-£ 58	-185 kg (40.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£58 2.32 kg/m²	A 93	A 95
Total Savings	£58 2.32 kg/m²		
Potential energy efficiency rating:		A 93	
Potential environmental impact rating:			A 95

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£124	£138	-£14
Mains gas	£430	£358	£72
Space heating	£316	£316	£0
Water heating	£135	£77	£58
Lighting	£102	£102	£0
Generated (PV)	-£392	-£392	£0
Total cost of fuels	£162	£104	£58
Total cost of uses	£161	£103	£58
Delivered energy	43 kWh/m²	31 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	6 kg/m²	3 kg/m²	2 kg/m²
Primary energy	31 kWh/m²	18 kWh/m²	13 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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.4420 (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)	=	0.4088 (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	0.5212	0.5110	0.5008	0.4497	0.4395	0.3884	0.3884	0.3781	0.4088	0.4395	0.4599	0.4804 (22b)
Effective ac	0.6358	0.6306	0.6254	0.6011	0.5966	0.5754	0.5754	0.5715	0.5836	0.5966	0.6058	0.6154 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (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	43.2731	42.9141	42.5622	40.9094	40.6002	39.1607	39.1607	38.8941	39.7151	40.6002	41.2258	41.8798 (38)
Heat transfer coeff	99.1547	98.7957	98.4438	96.7910	96.4818	95.0423	95.0423	94.7757	95.5968	96.4818	97.1074	97.7614 (39)
Average = Sum(39)m / 12 =												96.7896 (39)
HLP	1.2429	1.2384	1.2339	1.2132	1.2093	1.1913	1.1913	1.1880	1.1983	1.2093	1.2172	1.2254 (40)
HLP (average)												1.2132 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1079.5246 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1813.6014 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2449 (H8)	
Utilisation factor												0.5521 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												92.5935 (H14)	
Volume ratio Veff/V												0.8100 (H15)	
Solar storage volume factor												0.9579 (H16)	
Solar input	-24.4568	-40.8113	-69.5064	-93.1523	-115.0818	-113.1437	-111.6485	-97.5478	-76.3995	-52.1719	-29.0093	-843.3953 (H17)	
Solar input												-20.4662 (63)	
												-843.3953 (63)	
Solar input (sum of months) = Sum(63)m =													
Output from w/h	140.7071	104.0299	80.8795	39.2667	12.9499	0.0000	0.0000	21.0655	43.0318	85.2666	119.3239	139.9203 (64)	
												786.4412 (64)	
Total per year (kWh/year) = Sum(64)m =													
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (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	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(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					3.0000	11.2829	0.4600	0.0000	0.7700		11.9893	(75)
Southwest					5.0600	36.7938	0.4600	0.0000	0.7700		65.9438	(79)
Northwest					0.7200	11.2829	0.4600	0.0000	0.7700		2.8774	(81)
Northeast					4.5100	11.2829	0.4600	0.0000	0.7700		18.0238	(75)

Solar gains	98.8343	179.2763	274.3122	388.5255	479.5768	495.6370	469.7202	398.8064	313.3938	205.9627	120.3703	83.2942 (83)
Total gains	652.8268	728.8662	802.5217	883.6221	940.7997	926.5252	882.8928	820.2602	753.9171	679.8104	631.2348	622.1362 (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	33.7119	33.8344	33.9553	34.5351	34.6458	35.1706	35.1706	35.2695	34.9666	34.6458	34.4226	34.1924
alpha	3.2475	3.2556	3.2637	3.3023	3.3097	3.3447	3.3447	3.3513	3.3311	3.3097	3.2948	3.2795
util living area	0.9699	0.9557	0.9269	0.8621	0.7495	0.5907	0.4523	0.4995	0.7153	0.8907	0.9548	0.9738 (86)
MIT	19.2883	19.5019	19.8532	20.3095	20.6755	20.8966	20.9681	20.9555	20.7963	20.3282	19.7412	19.2573 (87)
Th 2	19.8859	19.8894	19.8929	19.9094	19.9125	19.9270	19.9270	19.9296	19.9214	19.9125	19.9063	19.8997 (88)
util rest of house	0.9639	0.9469	0.9120	0.8337	0.6983	0.5110	0.3506	0.3956	0.6420	0.8617	0.9442	0.9686 (89)
MIT 2	17.6400	17.9488	18.4517	19.0968	19.5776	19.8455	19.9105	19.9048	19.7417	19.1394	18.3083	17.6041 (90)
Living area fraction	fLA = Living area / (4) =											0.2066 (91)
MIT	17.9805	18.2696	18.7412	19.3473	19.8044	20.0626	20.1290	20.1218	19.9595	19.3849	18.6043	17.9456 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8305	18.1196	18.5912	19.1973	19.6544	19.9126	19.9790	19.9718	19.8095	19.2349	18.4543	17.7956 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9481	0.9278	0.8894	0.8115	0.6846	0.5099	0.3558	0.3999	0.6335	0.8392	0.9251	0.9541	(94)
Useful gains	618.9251	676.2382	713.7781	717.0375	644.1053	472.4340	314.1194	328.0568	477.6059	570.4843	583.9691	593.5767	(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	1341.6128	1306.0397	1190.3056	996.6874	767.4559	504.9234	321.1456	338.5195	545.8138	833.1136	1102.5822	1329.1209	(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	537.6797	423.2266	354.5365	201.3479	91.7729	0.0000	0.0000	0.0000	0.0000	195.3962	373.4015	547.2449	(98)
Space heating												2724.6062	(98)
Space heating per m2											(98) / (4) =	34.1515	(99)

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3010.6145 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.6797	423.2266	354.5365	201.3479	91.7729	0.0000	0.0000	0.0000	0.0000	195.3962	373.4015	547.2449	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	594.1212	467.6537	391.7531	222.4839	101.4065	0.0000	0.0000	0.0000	0.0000	215.9074	412.5983	604.6905	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	140.7071	104.0299	80.8795	39.2667	12.9499	0.0000	0.0000	21.0655	43.0318	85.2666	119.3239	139.9203	(64)
Efficiency of water heater	89.8171	89.8502	89.8880	89.9619	90.0916	87.3000	87.3000	87.3000	87.3000	89.5033	89.7037	87.3000	(216)
(217)m	89.8171	89.8502	89.8880	89.9619	90.0916	87.3000	87.3000	87.3000	87.3000	89.5033	89.7037	89.8295	(217)
Fuel for water heating, kWh/month	156.6595	115.7815	89.9781	43.6482	14.3741	0.0000	0.0000	24.1300	49.2919	95.2664	133.0201	155.7621	(219)
Water heating fuel used												877.9118	(219)
Annual totals kWh/year													
Space heating fuel - main system												3010.6145	(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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													356.9126 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												3151.8819	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3010.6145	3.4800	104.7694	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	877.9118	3.4800	30.5513	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	356.9126	13.1900	47.0768	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1218.5571	13.1900	-160.7277	(252)
Total energy cost			158.1573	(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] =	0.5323 (257)
SAP value			92.5738
SAP rating (Section 12)			93 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3010.6145	0.2160	650.2927	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	877.9118	0.2160	189.6290	(264)
Space and water heating			839.9217	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				
PV Unit	-1218.5571	0.5190	-632.4311	(269)
Total kg/year			457.6032	(272)
CO2 emissions per m2			5.7400	(273)
EI value			95.0858	
EI rating			95	(274)
EI band			A	

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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 206.2313 (5)
Dwelling volume			

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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					4.9600
Infiltration rate					0.4420 (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) =		0.4088 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.4293	0.3986	0.4088	0.3884	0.3884	0.3781	0.3679	0.3577	0.3475	0.3781	0.3577	0.3781 (22b)
Effective ac	0.5921	0.5794	0.5836	0.5754	0.5754	0.5715	0.5677	0.5640	0.5604	0.5715	0.5640	0.5715 (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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (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	40.2981	39.4344	39.7151	39.1607	39.1607	38.8941	38.6346	38.3823	38.1370	38.8941	38.3823	38.8941 (38)
Heat transfer coeff	96.1797	95.3160	95.5968	95.0423	95.0423	94.7757	94.5163	94.2639	94.0186	94.7757	94.2639	94.7757 (39)
Average = Sum(39)m / 12 =												94.8806 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2056	1.1947	1.1983	1.1913	1.1913	1.1880	1.1847	1.1815	1.1785	1.1880	1.1815	1.1880 (40)
HLP (average)												1.1893 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1208.1510 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												2029.6937 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.3932 (H8)	
Utilisation factor												0.5122 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												92.5935 (H14)	
Volume ratio Veff/V												0.8100 (H15)	
Solar storage volume factor												0.9579 (H16)	
Solar input	-28.5619	-40.6132	-69.8043	-94.1822	-110.6226	-118.1624	-115.6775	-103.5348	-81.0606	-56.0425	-33.7812	-875.5295 (H17)	
Solar input												-23.4862 (63)	
												-875.5295 (63)	
												Solar input (sum of months) = Sum(63)m =	
Output from w/h	136.6020	104.2280	80.5815	38.2368	17.4090	0.0000	0.0000	15.0785	38.3707	81.3959	114.5520	136.9003 (64)	
												Total per year (kWh/year) = Sum(64)m =	763.3548 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (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	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(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)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(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					3.0000	14.6176	0.4600	0.0000	0.7700		15.5327 (75)	
Southwest					5.0600	45.1778	0.4600	0.0000	0.7700		80.9700 (79)	
Northwest					0.7200	14.6176	0.4600	0.0000	0.7700		3.7279 (81)	
Northeast					4.5100	14.6176	0.4600	0.0000	0.7700		23.3508 (75)	

Solar gains	123.5815	191.6670	297.7436	426.8829	501.9417	563.6258	529.9494	460.5125	360.2735	238.1996	150.2084	102.2626 (83)
Total gains	677.5739	741.2570	825.9531	921.9795	963.1646	994.5140	943.1220	881.9664	800.7968	712.0473	661.0730	641.1046 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9a, 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	34.7547	35.0696	34.9666	35.1706	35.1706	35.2695	35.3663	35.4610	35.5535	35.2695	35.4610	35.2695
alpha	3.3170	3.3380	3.3311	3.3447	3.3447	3.3513	3.3578	3.3641	3.3702	3.3513	3.3641	3.3513
util living area	0.9627	0.9492	0.9125	0.8305	0.6981	0.5087	0.3805	0.4037	0.6445	0.8542	0.9392	0.9670 (86)
MIT	19.4854	19.6563	20.0100	20.4448	20.7703	20.9417	20.9834	20.9804	20.8703	20.4879	19.9558	19.4779 (87)
Th 2	19.9156	19.9242	19.9214	19.9270	19.9270	19.9296	19.9323	19.9348	19.9373	19.9296	19.9348	19.9296 (88)
util rest of house	0.9552	0.9392	0.8949	0.7968	0.6394	0.4248	0.2809	0.2992	0.5627	0.8164	0.9251	0.9602 (89)
MIT 2	17.9427	18.1922	18.6911	19.2900	19.7033	19.8892	19.9253	19.9264	19.8330	19.3650	18.6323	17.9418 (90)
Living area fraction									fLa = Living area / (4) =			0.2066 (91)
MIT	18.2614	18.4946	18.9635	19.5286	19.9237	20.1066	20.1439	20.1441	20.0473	19.5969	18.9057	18.2591 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1114	18.3446	18.8135	19.3786	19.7737	19.9566	19.9939	19.9941	19.8973	19.4469	18.7557	18.1091 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9379	0.9196	0.8723	0.7768	0.6302	0.4271	0.2868	0.3052	0.5593	0.7959	0.9044	0.9442	(94)
Useful gains	635.4985	681.6833	720.4894	716.1720	606.9973	424.7240	270.4604	269.1502	447.8943	566.7043	597.8709	605.3021	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1270.6691	1243.3618	1129.3351	938.8802	691.3114	441.3348	273.5162	272.8099	488.6418	762.6553	1023.2979	1242.4267	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	472.5669	377.4480	304.1812	160.3499	62.7296	0.0000	0.0000	0.0000	0.0000	145.7875	306.3075	474.0207	(98)
Space heating												2303.3914	(98)
Space heating per m2												28.8718	(99)
												(98) / (4) =	

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2545.1839 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	472.5669	377.4480	304.1812	160.3499	62.7296	0.0000	0.0000	0.0000	0.0000	145.7875	306.3075	474.0207	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	522.1734	417.0696	336.1119	177.1822	69.3145	0.0000	0.0000	0.0000	0.0000	161.0912	338.4613	523.7798	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	136.6020	104.2280	80.5815	38.2368	17.4090	0.0000	0.0000	15.0785	38.3707	81.3959	114.5520	136.9003	(64)
Efficiency of water heater	89.7622	89.7878	89.8105	89.8657	89.7851	87.3000	87.3000	87.3000	87.3000	89.3269	89.6060	87.3000	(216)
(217)m	89.7622	89.7878	89.8105	89.8657	89.7851	87.3000	87.3000	87.3000	87.3000	89.3269	89.6060	87.3000	(217)
Fuel for water heating, kWh/month	152.1821	116.0826	89.7239	42.5488	19.3896	0.0000	0.0000	17.2721	43.9527	91.1214	127.8397	152.5136	(219)
Water heating fuel used												852.6265	(219)
Annual totals kWh/year												2545.1839	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													356.9126 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =										-1368.9771		-1368.9771	(233)
Total delivered energy for all uses												2510.7458	(238)

10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2545.1839	7.3800	187.8346	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	852.6265	7.3800	62.9238	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	356.9126	28.6600	102.2912	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1368.9771	28.6600	-392.3488	(252)
Total energy cost			103.5257	(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	2545.1839	0.2160	549.7597	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	852.6265	0.2160	184.1673	(264)
Space and water heating			733.9270	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				

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Calculation Type: New Build (As Built)

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

PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			273.5406 (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	2545.1839	1.2200	3105.1243 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	852.6265	1.2200	1040.2043 (264)
Space and water heating			4145.3286 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	356.9126	3.0700	1095.7218 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			1422.0406 (272)
Primary energy kWh/m2/year			17.8245 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	150.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	272.23 (P1)
Transmission heat loss coefficient	55.88 (37)
Summer heat loss coefficient	328.11 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.0000	106.0502	0.4600	0.0000	0.9000	131.7144
South West	5.0600	127.3119	0.4600	0.0000	0.9000	266.6980
North West	0.7200	106.0502	0.4600	0.0000	0.9000	31.6114
North East	4.5100	106.0502	0.4600	0.0000	0.9000	198.0106

total:						628.0344
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	Jun	Jul	Aug	
Solar gains	679	628	544	(P4)
Internal gains	428	410	418	
Total summer gains	1107	1038	962	(P5)

	3.37	3.16	2.93	
Summer gain/loss ratio	3.37	3.16	2.93	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 150.8)	0.94	0.94	0.94	
Threshold temperature	19.72	21.41	21.18	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			