

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-599				Issued on Date	22/03/2023
Assessment Reference	Plot 599	Prop Type Ref	Badlesmere-OP-SEMI			
Property	Plot 599, 2 Bed, K, WC, Ut, B, En					
SAP Rating	84 B	DER	17.41	TER	18.80	
Environmental	86 B	% DER<TER	7.37			
CO ₂ Emissions (t/year)	1.15	DFEE	46.37	TFEE	53.76	
General Requirements Compliance	Pass	% DFEE<TFEE	13.76			
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 DESIGNED

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) 18.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.41 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.4 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: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 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 (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 7.51 m², No overhang
Windows facing South: 5.06 m², No overhang
Windows facing 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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4445 (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) =		0.4111 (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	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
Effective ac	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (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	43.3780	43.0149	42.6590	40.9875	40.6747	39.2189	39.2189	38.9493	39.7797	40.6747	41.3074	41.9688 (38)
Heat transfer coeff	99.2596	98.8965	98.5406	96.8691	96.5564	95.1005	95.1005	94.8309	95.6613	96.5564	97.1890	97.8505 (39)
Average = Sum(39)m / 12 =												96.8676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (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)

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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	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
North					3.0000	10.6334		0.4600		0.0000	0.7700	11.2990 (74)
South					5.0600	46.7521		0.4600		0.0000	0.7700	83.7915 (78)
West					0.7200	19.6403		0.4600		0.0000	0.7700	5.0087 (80)
North					4.5100	10.6334		0.4600		0.0000	0.7700	16.9862 (74)
Solar gains	117.0855	201.0816	282.7934	368.6393	433.4662	440.4182	420.3357	369.7398	311.8076	223.9855	140.4603	100.1025 (83)
Total gains	491.4031	573.2670	641.4469	705.5037	748.2219	733.8927	700.0110	655.4261	608.7147	542.8932	484.6200	463.1861 (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	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9863	0.9766	0.9582	0.9160	0.8324	0.6933	0.5496	0.5970	0.7991	0.9354	0.9778	0.9886 (86)
MIT	19.0375	19.2707	19.6345	20.1133	20.5356	20.8306	20.9428	20.9237	20.7061	20.1621	19.5226	19.0066 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9834	0.9716	0.9488	0.8958	0.7896	0.6128	0.4339	0.4828	0.7337	0.9157	0.9722	0.9862 (89)
MIT 2	17.2781	17.6182	18.1454	18.8358	19.4122	19.7853	19.8951	19.8838	19.6474	18.9180	17.9973	17.2417 (90)
Living area fraction	fLA = Living area / (4) = 0.2066 (91)											
MIT	17.6416	17.9596	18.4530	19.0997	19.6442	20.0013	20.1115	20.0986	19.8661	19.1750	18.3124	17.6063 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4916	17.8096	18.3030	18.9497	19.4942	19.8513	19.9615	19.9486	19.7161	19.0250	18.1624	17.4563 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9736	0.9579	0.9301	0.8731	0.7701	0.6066	0.4380	0.4851	0.7189	0.8942	0.9588	0.9777 (94)
Useful gains	478.4392	549.1202	596.5902	615.9821	576.2034	445.1506	306.6082	317.9455	437.6044	485.4418	464.6655	452.8705 (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	1309.3879	1276.7125	1163.0731	973.5056	752.5833	499.3976	319.6836	336.5183	537.2448	813.4901	1075.1445	1297.1317 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	618.2259	488.9418	421.4632	257.4169	131.2267	0.0000	0.0000	0.0000	0.0000	244.0680	439.5449	628.1304 (98)
Space heating												3229.0177 (98)
Space heating per m2												(98) / (4) = 40.4740 (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												3567.9754 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	618.2259	488.9418	421.4632	257.4169	131.2267	0.0000	0.0000	0.0000	0.0000	244.0680	439.5449	628.1304 (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)	683.1225	540.2671	465.7052	284.4386	145.0019	0.0000	0.0000	0.0000	0.0000	269.6883	485.6849	694.0667 (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	89.8060	89.7482	89.6359	89.3870	88.8909	87.3000	87.3000	87.3000	87.3000	89.3205	89.6707	87.3000 (216)
Fuel for water heating, kWh/month	183.9119	161.3863	167.7740	148.1411	144.0323	128.1956	120.4190	135.8687	136.8056	153.8711	165.4200	178.5440 (219)
Water heating fuel used												1824.3695 (219)
Annual totals kWh/year												1824.3695 (219)
Space heating fuel - main system												3567.9754 (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												5824.2576 (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	3567.9754	0.2160	770.6827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1824.3695	0.2160	394.0638 (264)
Space and water heating			1164.7465 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total CO2, kg/year			1388.9092 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4100 (273)

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

DER		17.4100 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		35.9063 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		35.9063 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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
North					7.5100	10.6334	0.6300	0.7000			0.7700			24.4053 (74)
South					5.0600	46.7521	0.6300	0.7000			0.7700			72.2975 (78)
West					0.7200	19.6403	0.6300	0.7000			0.7700			4.3217 (80)
Solar gains	101.0244	173.4985	244.0015	318.0716	374.0060	380.0044	362.6766	319.0211	269.0357	193.2605	121.1928			86.3710 (83)
Total gains	487.7210	557.7519	614.1008	665.7616	698.9628	683.0575	651.9377	614.9152	576.7782	523.6239	477.4262			461.8374 (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	0.9978	0.9954	0.9891	0.9685	0.9066	0.7637	0.5949	0.6471	0.8705	0.9776	0.9955	0.9984	(86)
MIT	19.7204	19.8716	20.1136	20.4389	20.7335	20.9256	20.9832	20.9748	20.8453	20.4707	20.0401	19.6980	(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	0.9971	0.9938	0.9851	0.9558	0.8677	0.6736	0.4658	0.5185	0.8037	0.9662	0.9937	0.9978	(89)
MIT 2	18.2293	18.4519	18.8057	19.2811	19.6820	19.9122	19.9576	19.9554	19.8311	19.3337	18.7082	18.2045	(90)
Living area fraction	18.5373	18.7452	19.0759	19.5202	19.8992	20.1216	20.1695	20.1659	20.0406	19.5686	18.9834	18.5130	(91)
MIT	18.5373	18.7452	19.0759	19.5202	19.8992	20.1216	20.1695	20.1659	20.0406	19.5686	18.9834	18.5130	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5373	18.7452	19.0759	19.5202	19.8992	20.1216	20.1695	20.1659	20.0406	19.5686	18.9834	18.5130	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9912	0.9806	0.9491	0.8653	0.6887	0.4926	0.5449	0.8098	0.9604	0.9912	0.9966	(94)
Useful gains	485.5814	552.8443	602.1784	631.8748	604.8041	470.4341	321.1155	335.0796	467.0947	502.9103	473.2204	460.2740	(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	1347.7850	1306.6825	1183.3453	985.2731	758.6328	504.5206	326.1525	343.3016	545.4485	829.8239	1105.4674	1338.9861	(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	641.4794	506.5793	432.3882	254.4468	114.4485	0.0000	0.0000	0.0000	0.0000	243.2237	455.2178	653.7619	(98)
Space heating												3301.5456	(98)
Space heating per m2												41.3831	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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												3534.8454 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	641.4794	506.5793	432.3882	254.4468	114.4485	0.0000	0.0000	0.0000	0.0000	243.2237	455.2178	653.7619 (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)	686.8088	542.3761	462.9424	272.4270	122.5359	0.0000	0.0000	0.0000	0.0000	260.4109	487.3852	699.9592 (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	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	87.7566	87.5455	87.1232	86.1591	84.2484	80.3000	80.3000	80.3000	80.3000	85.9301	87.2520	80.3000 (216)
Fuel for water heating, kWh/month	230.1865	202.5007	211.7100	189.8774	188.0041	173.7253	166.4421	185.5439	187.5930	199.6164	209.8582	224.5438 (219)
Water heating fuel used												2369.6015 (219)
Annual totals kWh/year												
Space heating fuel - main system												3534.8454 (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												6336.3596 (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	3534.8454	0.2160	763.5266 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2369.6015	0.2160	511.8339 (264)
Space and water heating			1275.3605 (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			1499.5232 (272)
Emissions per m2 for space and water heating			15.9860 (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) = (15.9860 * 1.00) + 2.3219 + 0.4879, rounded to 2 d.p.			18.8000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.3960 (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) =	0.3663 (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	0.4670	0.4578	0.4487	0.4029	0.3937	0.3480	0.3480	0.3388	0.3663	0.3937	0.4121	0.4304 (22b)
Effective ac	0.6090	0.6048	0.6007	0.5812	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (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	41.4492	41.1610	40.8785	39.5518	39.3036	38.1481	38.1481	37.9341	38.5932	39.3036	39.8058	40.3307 (38)
Heat transfer coeff	97.3308	97.0426	96.7602	95.4335	95.1852	94.0297	94.0297	93.8157	94.4748	95.1852	95.6874	96.2124 (39)
Average = Sum(39)m / 12 =												95.4323 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2200	1.2164	1.2128	1.1962	1.1931	1.1786	1.1786	1.1759	1.1842	1.1931	1.1994	1.2060 (40)
HLP (average)												1.1962 (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 Designed)

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
North			3.0000		10.6334		0.4600		0.0000		0.7700		11.2990 (74)
South			5.0600		46.7521		0.4600		0.0000		0.7700		83.7915 (78)
West			0.7200		19.6403		0.4600		0.0000		0.7700		5.0087 (80)
North			4.5100		10.6334		0.4600		0.0000		0.7700		16.9862 (74)
Solar gains	117.0855	201.0816	282.7934	368.6393	433.4662	440.4182	420.3357	369.7398	311.8076	223.9855	140.4603	100.1025	(83)
Total gains	459.2968	541.9386	611.7334	677.9835	722.1263	709.8010	677.6197	630.8530	583.3641	515.2731	454.4368	431.8522	(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	34.3436	34.4456	34.5462	35.0264	35.1178	35.5493	35.5493	35.6304	35.3818	35.1178	34.9335	34.7429	
alpha	3.2896	3.2964	3.3031	3.3351	3.3412	3.3700	3.3700	3.3754	3.3588	3.3412	3.3289	3.3162	
util living area	0.9887	0.9799	0.9626	0.9224	0.8410	0.7039	0.5596	0.6100	0.8114	0.9425	0.9814	0.9908	(86)
MIT	19.0279	19.2619	19.6266	20.1031	20.5288	20.8261	20.9412	20.9204	20.6965	20.1450	19.5035	18.9916	(87)
Th 2	19.9040	19.9069	19.9097	19.9230	19.9255	19.9371	19.9371	19.9393	19.9327	19.9255	19.9205	19.9152	(88)
util rest of house	0.9863	0.9755	0.9541	0.9035	0.7997	0.6245	0.4438	0.4959	0.7481	0.9247	0.9766	0.9887	(89)
MIT 2	18.1096	18.3436	18.7056	19.1786	19.5772	19.8374	19.9150	19.9066	19.7379	19.2284	18.5951	18.0817	(90)
Living area fraction	18.2993	18.5333	18.8958	19.3696	19.7738	20.0417	20.1269	20.1161	19.9359	19.4177	18.7828	18.2697	(92)
Temperature adjustment	18.2993	18.5333	18.8958	19.3696	19.7738	20.0417	20.1269	20.1161	19.9359	19.4177	18.7828	18.2697	(93)
adjusted MIT	18.2993	18.5333	18.8958	19.3696	19.7738	20.0417	20.1269	20.1161	19.9359	19.4177	18.7828	18.2697	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	450.7043	524.6863	577.4145	604.5115	572.6424	449.3692	315.6965	325.8559	436.5711	470.9728	440.6824	425.1505	(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	1362.5652	1323.0098	1199.4222	999.1466	768.5030	511.6779	331.6378	348.6242	551.3479	839.3168	1117.8928	1353.6773	(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	678.4245	536.4734	462.7737	284.1373	145.7203	0.0000	0.0000	0.0000	0.0000	274.0480	487.5915	690.8240	(98)
Space heating													3559.9926 (98)
Space heating per m2													44.6226 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	883.8794	695.8199	712.9996	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7870	0.8529	0.8258	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	695.6070	593.4451	588.8016	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	921.5710	882.0828	829.0442	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	162.6941	214.7464	178.7405	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			556.1811 (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	40.6735	53.6866	44.6851	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												139.0453 (107)
Energy for space heating												1.7429 (108)
Energy for space cooling												44.6226 (99)
Total												1.7429 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.3655 (109)
												46.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)
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												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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 Designed)

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	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	7.5100	10.6334	0.6300		0.7000	0.7700	24.4053 (74)
South	5.0600	46.7521	0.6300		0.7000	0.7700	72.2975 (78)
West	0.7200	19.6403	0.6300		0.7000	0.7700	4.3217 (80)

Solar gains	101.0244	173.4985	244.0015	318.0716	374.0060	380.0044	362.6766	319.0211	269.0357	193.2605	121.1928	86.3710 (83)
Total gains	443.2357	514.3555	572.9415	627.4158	662.6661	649.3871	619.9606	580.1344	540.5923	484.5482	435.1693	418.1208 (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, nilm (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	0.9986	0.9968	0.9919	0.9749	0.9211	0.7879	0.6208	0.6776	0.8925	0.9836	0.9970	0.9990 (86)
MIT	19.6689	19.8219	20.0678	20.4000	20.7061	20.9138	20.9798	20.9691	20.8222	20.4293	19.9915	19.6471 (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	0.9981	0.9956	0.9888	0.9645	0.8862	0.6999	0.4884	0.5467	0.8320	0.9749	0.9958	0.9986 (89)
MIT 2	18.7177	18.8726	19.1194	19.4566	19.7451	19.9221	19.9586	19.9569	19.8556	19.4906	19.0531	18.7050 (90)
Living area fraction									fLA = Living area / (4) =			0.2066 (91)
MIT	18.9142	19.0687	19.3153	19.6515	19.9437	20.1269	20.1696	20.1659	20.0553	19.6845	19.2470	18.8996 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9142	19.0687	19.3153	19.6515	19.9437	20.1269	20.1696	20.1659	20.0553	19.6845	19.2470	18.8996 (93)

8. Space heating requirement

Utilisation	Jan 0.9974	Feb 0.9944	Mar 0.9864	Apr 0.9607	May 0.8858	Jun 0.7154	Jul 0.5161	Aug 0.5740	Sep 0.8387	Oct 0.9719	Nov 0.9946	Dec 0.9981 (94)
Useful gains	442.0971	511.4507	565.1490	602.7535	587.0102	464.5601	319.9698	332.9720	453.3857	470.9227	432.8299	417.3158 (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	1383.4632	1337.2166	1205.8774	997.4459	762.7479	505.0122	326.1603	343.3016	546.7966	840.5460	1129.9870	1375.1487 (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	700.3764	554.9147	476.7019	284.1785	130.7488	0.0000	0.0000	0.0000	0.0000	274.9997	501.9531	712.6277 (98)
Space heating												3636.5009 (98)
Space heating per m2										(98) / (4) =		45.5816 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 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	0.8306	0.9017	0.8754	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	713.4029	609.6779	606.4992	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	850.9574	814.6890	769.7627	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	99.0393	152.5283	121.4680	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												373.0355 (104)

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Calculation Type: New Build (As Designed)



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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	24.7598	38.1321	30.3670	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.2589 (107)
Space cooling per m2												1.1690 (108)
Energy for space heating												45.5816 (99)
Energy for space cooling												1.1690 (108)
Total												46.7506 (109)
Target Fabric Energy Efficiency (TFEE)												53.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4445 (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)	=	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (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	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (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 Designed)

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)
RHI water heating demand												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
North			3.0000		11.9814		0.4600		0.0000		0.7700		12.7315 (74)
South			5.0600		50.9848		0.4600		0.0000		0.7700		91.3777 (78)
West			0.7200		22.3313		0.4600		0.0000		0.7700		5.6950 (80)
North			4.5100		11.9814		0.4600		0.0000		0.7700		19.1397 (74)
Solar gains	128.9438	199.6200	278.7616	377.4744	434.9345	473.9059	447.0245	400.3674	334.1862	237.7832	158.5288	109.1501	(83)
Total gains	682.9362	749.2099	806.9711	872.5710	896.1575	904.7941	860.1971	821.8213	774.7095	711.6309	669.3933	647.9921	(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	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9606	0.9453	0.9114	0.8364	0.7023	0.4897	0.3331	0.3567	0.6218	0.8472	0.9361	0.9655 (86)
MIT	19.5227	19.7051	20.0426	20.4521	20.7806	20.9556	20.9914	20.9892	20.8936	20.5177	19.9807	19.4965 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9526	0.9344	0.8930	0.8021	0.6398	0.3965	0.2216	0.2423	0.5328	0.8075	0.9212	0.9584 (89)
MIT 2	17.9961	18.2599	18.7378	19.3046	19.7210	19.9121	19.9344	19.9384	19.8597	19.4078	18.6669	17.9665 (90)
Living area fraction	18.3114	18.5584	19.0073	19.5416	19.9399	20.1277	20.1528	20.1554	20.0732	19.6371	18.9383	18.2826 (91)
MIT	18.3114	18.5584	19.0073	19.5416	19.9399	20.1277	20.1528	20.1554	20.0732	19.6371	18.9383	18.2826 (92)
Temperature adjustment									fLA = Living area / (4) =			0.2066 (91)
adjusted MIT	18.1614	18.4084	18.8573	19.3916	19.7899	19.9777	20.0028	20.0054	19.9232	19.4871	18.7883	-0.1500
												18.1326 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	638.4873	684.9833	702.3979	682.2830	565.3615	361.9298	196.7181	204.9576	411.6285	560.4475	602.6303	610.3722	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1257.1723	1225.2673	1096.0233	900.0985	643.8907	373.2013	197.7963	206.4075	443.1541	743.8581	1017.4778	1239.4069	(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	460.3016	363.0709	292.8573	156.8272	58.4257	0.0000	0.0000	0.0000	0.0000	136.4575	298.6902	468.0019	(98)
Space heating												2234.6322	(98)
RHI space heating demand												2235	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4445 (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) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (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	43.3780	43.0149	42.6590	40.9875	40.6747	39.2189	39.2189	38.9493	39.7797	40.6747	41.3074	41.9688 (38)
Heat transfer coeff	99.2596	98.8965	98.5406	96.8691	96.5564	95.1005	95.1005	94.8309	95.6613	96.5564	97.1890	97.8505 (39)
Average = Sum(39)m / 12 =												96.8676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (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 Designed)

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)	
								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
North				3.0000		10.6334	0.4600		0.0000		0.7700		11.2990 (74)
South				5.0600		46.7521	0.4600		0.0000		0.7700		83.7915 (78)
West				0.7200		19.6403	0.4600		0.0000		0.7700		5.0087 (80)
North				4.5100		10.6334	0.4600		0.0000		0.7700		16.9862 (74)
Solar gains	117.0855	201.0816	282.7934	368.6393	433.4662	440.4182	420.3357	369.7398	311.8076	223.9855	140.4603	100.1025	(83)
Total gains	671.0779	750.6715	811.0028	863.7359	894.6892	871.3064	833.5083	791.1937	752.3308	697.8332	651.3248	638.9445	(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	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9677	0.9523	0.9251	0.8686	0.7693	0.6182	0.4757	0.5150	0.7164	0.8844	0.9510	0.9719 (86)
MIT	19.3130	19.5303	19.8620	20.2886	20.6460	20.8812	20.9628	20.9511	20.7950	20.3467	19.7678	19.2807 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9612	0.9429	0.9099	0.8410	0.7195	0.5375	0.3702	0.4090	0.6432	0.8543	0.9397	0.9663 (89)
MIT 2	17.6747	17.9882	18.4631	19.0689	19.5431	19.8315	19.9070	19.9015	19.7399	19.1628	18.3451	17.6370 (90)
Living area fraction	18.0131	18.3068	18.7521	19.3209	19.7709	20.0483	20.1251	20.1184	19.9578	19.4073	18.6389	17.9766 (91)
MIT	18.0131	18.3068	18.7521	19.3209	19.7709	20.0483	20.1251	20.1184	19.9578	19.4073	18.6389	17.9766 (92)
Temperature adjustment	17.8631	18.1568	18.6021	19.1709	19.6209	19.8983	19.9751	19.9684	19.8078	19.2573	18.4889	-0.1500
adjusted MIT	17.8631	18.1568	18.6021	19.1709	19.6209	19.8983	19.9751	19.9684	19.8078	19.2573	18.4889	17.8266 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	634.0010	692.9943	719.5331	706.9850	630.2787	466.3426	312.7189	326.8477	477.3777	580.4829	599.2169	607.7460	(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	1346.2693	1311.0471	1192.5480	994.9296	764.8156	503.8714	320.9722	338.3903	546.0180	835.9217	1106.8811	1333.3662	(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	529.9276	415.3315	351.9231	207.3201	100.0955	0.0000	0.0000	0.0000	0.0000	190.0465	365.5182	539.8614	(98)
Space heating												2700.0240	(98)
Space heating per m2												33.8434	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2983.4520 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	529.9276	415.3315	351.9231	207.3201	100.0955	0.0000	0.0000	0.0000	0.0000	190.0465	365.5182	539.8614	(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)	585.5554	458.9298	388.8653	229.0830	110.6028	0.0000	0.0000	0.0000	0.0000	209.9962	403.8875	596.5319	(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	89.7186	89.6503	89.5176	89.2252	88.6758	87.3000	87.3000	87.3000	87.3000	89.1289	89.5524	87.3000	(216)
Fuel for water heating, kWh/month	184.0911	161.5624	167.9958	148.4098	144.3817	128.1956	120.4190	135.8687	136.8056	154.2019	165.6384	178.7105	(219)
Water heating fuel used												1826.2805	(219)
Annual totals kWh/year													
Space heating fuel - main system												2983.4520	(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												5241.6451	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2983.4520	3.4800	103.8241 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1826.2805	3.4800	63.5546 (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)
Total energy cost			344.3480 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1590 (257)
SAP value		83.8313
SAP rating (Section 12)		84 (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	2983.4520	0.2160	644.4256 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.2805	0.2160	394.4766 (264)
Space and water heating			1038.9022 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total kg/year			1263.0649 (272)
CO2 emissions per m2			15.8300 (273)
EI value			86.4361
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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 Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 206.2313 (5)
Dwelling volume			

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					5.0100
Infiltration rate					0.4445 (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) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (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	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (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 Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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	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
North			3.0000		11.9814		0.4600		0.0000		0.7700		12.7315 (74)
South			5.0600		50.9848		0.4600		0.0000		0.7700		91.3777 (78)
West			0.7200		22.3313		0.4600		0.0000		0.7700		5.6950 (80)
North			4.5100		11.9814		0.4600		0.0000		0.7700		19.1397 (74)
Solar gains	128.9438	199.6200	278.7616	377.4744	434.9345	473.9059	447.0245	400.3674	334.1862	237.7832	158.5288	109.1501	(83)
Total gains	682.9362	749.2099	806.9711	872.5710	896.1575	904.7941	860.1971	821.8213	774.7095	711.6309	669.3933	647.9921	(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	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9606	0.9453	0.9114	0.8364	0.7023	0.4897	0.3331	0.3567	0.6218	0.8472	0.9361	0.9655 (86)
MIT	19.5227	19.7051	20.0426	20.4521	20.7806	20.9556	20.9914	20.9892	20.8936	20.5177	19.9807	19.4965 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9526	0.9344	0.8930	0.8021	0.6398	0.3965	0.2216	0.2423	0.5328	0.8075	0.9212	0.9584 (89)
MIT 2	17.9961	18.2599	18.7378	19.3046	19.7210	19.9121	19.9344	19.9384	19.8597	19.4078	18.6669	17.9665 (90)
Living area fraction	fLA = Living area / (4) =											0.2066 (91)
MIT	18.3114	18.5584	19.0073	19.5416	19.9399	20.1277	20.1528	20.1554	20.0732	19.6371	18.9383	18.2826 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1614	18.4084	18.8573	19.3916	19.7899	19.9777	20.0028	20.0054	19.9232	19.4871	18.7883	18.1326 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	638.4873	684.9833	702.3979	682.2830	565.3615	361.9298	196.7181	204.9576	411.6285	560.4475	602.6303	610.3722	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1257.1723	1225.2673	1096.0233	900.0985	643.8907	373.2013	197.7963	206.4075	443.1541	743.8581	1017.4778	1239.4069	(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	460.3016	363.0709	292.8573	156.8272	58.4257	0.0000	0.0000	0.0000	0.0000	136.4575	298.6902	468.0019	(98)
Space heating												2234.6322	(98)
Space heating per m2												(98) / (4) =	28.0099 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2469.2069 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.3016	363.0709	292.8573	156.8272	58.4257	0.0000	0.0000	0.0000	0.0000	136.4575	298.6902	468.0019	(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)	508.6206	401.1833	323.5993	173.2897	64.5588	0.0000	0.0000	0.0000	0.0000	150.7817	330.0444	517.1291	(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	89.6324	89.5638	89.3883	89.0064	88.2781	87.3000	87.3000	87.3000	87.3000	88.8655	89.4125	87.3000	(216)
Fuel for water heating, kWh/month	184.2680	161.7185	168.2388	148.7747	145.0322	128.1956	120.4190	135.8687	136.8056	154.6590	165.8977	178.8807	(219)
Water heating fuel used												1828.7584	(219)
Annual totals kWh/year													
Space heating fuel - main system												2469.2069	(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												4729.8779	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2469.2069	9.7400	240.5008 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.7584	9.7400	178.1211 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	356.9126	36.8500	131.5223 (250)
Additional standing charges			104.0000 (251)
Total energy cost			681.7816 (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	2469.2069	0.2160	533.3487 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.7584	0.2160	395.0118 (264)
Space and water heating			928.3605 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total kg/year			1152.5232 (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	2469.2069	1.2200	3012.4324 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.7584	1.2200	2231.0852 (264)
Space and water heating			5243.5177 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	356.9126	3.0700	1095.7218 (268)
Primary energy kWh/year			6569.4895 (272)
Primary energy kWh/m2/year			82.3451 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 75	-181 kg (15.7%)
U Solar photovoltaic panels	+ 10.7	-£ 672	-947 kg (97.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£75	2.27 kg/m²	B 85 B 88
Solar photovoltaic panels	£672	11.87 kg/m²	A 96 A 98
Total Savings	£747	14.14 kg/m²	

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£159	£178	-£18
Mains gas	£523	£429	£93
Space heating	£372	£372	£0
Water heating	£178	£103	£75
Lighting	£132	£132	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£682	-£65	£747
Total cost of uses	£682	-£65	£747
Delivered energy	59 kWh/m²	25 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	0 kg/m²	14 kg/m²
Primary energy	82 kWh/m²	-1 kWh/m²	83 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4445 (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) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (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	43.3780	43.0149	42.6590	40.9875	40.6747	39.2189	39.2189	38.9493	39.7797	40.6747	41.3074	41.9688 (38)
Heat transfer coeff	99.2596	98.8965	98.5406	96.8691	96.5564	95.1005	95.1005	94.8309	95.6613	96.5564	97.1890	97.8505 (39)
Average = Sum(39)m / 12 =												96.8676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (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 Designed)

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												-843.3953 (H17)	
Solar input	-24.4568	-40.8113	-69.5064	-93.1523	-115.0818	-113.1437	-111.6485	-97.5478	-76.3995	-52.1719	-29.0093	-20.4662 (63)	
	Solar input (sum of months) = Sum(63)m =											-843.3953 (63)	
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)	
	Total per year (kWh/year) = Sum(64)m =											786.4412 (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	
North				3.0000	10.6334	0.4600		0.0000		0.7700		11.2990 (74)	
South				5.0600	46.7521	0.4600		0.0000		0.7700		83.7915 (78)	
West				0.7200	19.6403	0.4600		0.0000		0.7700		5.0087 (80)	
North				4.5100	10.6334	0.4600		0.0000		0.7700		16.9862 (74)	

Solar gains	117.0855	201.0816	282.7934	368.6393	433.4662	440.4182	420.3357	369.7398	311.8076	223.9855	140.4603	100.1025	(83)
Total gains	671.0779	750.6715	811.0028	863.7359	894.6892	871.3064	833.5083	791.1937	752.3308	697.8332	651.3248	638.9445	(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	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9677	0.9523	0.9251	0.8686	0.7693	0.6182	0.4757	0.5150	0.7164	0.8844	0.9510	0.9719 (86)
MIT	19.3130	19.5303	19.8620	20.2886	20.6460	20.8812	20.9628	20.9511	20.7950	20.3467	19.7678	19.2807 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9612	0.9429	0.9099	0.8410	0.7195	0.5375	0.3702	0.4090	0.6432	0.8543	0.9397	0.9663 (89)
MIT 2	17.6747	17.9882	18.4631	19.0689	19.5431	19.8315	19.9070	19.9015	19.7399	19.1628	18.3451	17.6370 (90)
Living area fraction	fLA = Living area / (4) =											0.2066 (91)
MIT	18.0131	18.3068	18.7521	19.3209	19.7709	20.0483	20.1251	20.1184	19.9578	19.4073	18.6389	17.9766 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8631	18.1568	18.6021	19.1709	19.6209	19.8983	19.9751	19.9684	19.8078	19.2573	18.4889	17.8266 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9448	0.9232	0.8872	0.8185	0.7045	0.5352	0.3752	0.4131	0.6345	0.8318	0.9200	0.9512	(94)
Useful gains	634.0010	692.9943	719.5331	706.9850	630.2787	466.3426	312.7189	326.8477	477.3777	580.4829	599.2169	607.7460	(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	1346.2693	1311.0471	1192.5480	994.9296	764.8156	503.8714	320.9722	338.3903	546.0180	835.9217	1106.8811	1333.3662	(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	529.9276	415.3315	351.9231	207.3201	100.0955	0.0000	0.0000	0.0000	0.0000	190.0465	365.5182	539.8614	(98)
Space heating												2700.0240	(98)
Space heating per m2												33.8434	(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													2983.4520 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	529.9276	415.3315	351.9231	207.3201	100.0955	0.0000	0.0000	0.0000	0.0000	190.0465	365.5182	539.8614	(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)	585.5554	458.9298	388.8653	229.0830	110.6028	0.0000	0.0000	0.0000	0.0000	209.9962	403.8875	596.5319	(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	89.8093	89.8404	89.8843	89.9748	90.1216	87.3000	87.3000	87.3000	87.3000	89.4841	89.6909	87.3000	(216)
(217)m	89.8093	89.8404	89.8843	89.9748	90.1216	87.3000	87.3000	87.3000	87.3000	89.4841	89.6909	89.8223	(217)
Fuel for water heating, kWh/month	156.6732	115.7941	89.9817	43.6419	14.3693	0.0000	0.0000	24.1300	49.2919	95.2868	133.0391	155.7746	(219)
Water heating fuel used												877.9827	(219)
Annual totals kWh/year													
Space heating fuel - main system												2983.4520	(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 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												2616.1079	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2983.4520	3.4800	103.8241	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	877.9827	3.4800	30.5538	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			90.1193	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.3033 (257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	95.7685
SAP rating (Section 12)			96 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	2983.4520	0.2160	644.4256 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	877.9827	0.2160	189.6443 (264)
Space and water heating			834.0699 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			187.7453 (272)
CO2 emissions per m2			2.3500 (273)
EI value			97.9838
EI rating			98 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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		(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					5.0100
Infiltration rate					0.4445 (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) =		0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (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	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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												1140.0998 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1915.3676 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.3147 (H8)	
Utilisation factor												0.5326 (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	-26.4463	-39.7487	-66.9419	-92.5342	-111.4423	-117.2882	-114.4719	-102.2241	-79.7862	-54.2771	-32.1462	-859.2180 (H17)	
Solar input												-21.9109 (63)	
	Solar input (sum of months) = Sum(63)m =											-859.2180 (63)	
Output from w/h	138.7176	105.0925	83.4439	39.8847	16.5893	0.0000	0.0000	16.3893	39.6451	83.1613	116.1870	138.4756 (64)	
	Total per year (kWh/year) = Sum(64)m =											777.5864 (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	
North				3.0000	11.9814		0.4600		0.0000		0.7700		12.7315 (74)	
South				5.0600	50.9848		0.4600		0.0000		0.7700		91.3777 (78)	
West				0.7200	22.3313		0.4600		0.0000		0.7700		5.6950 (80)	
North				4.5100	11.9814		0.4600		0.0000		0.7700		19.1397 (74)	
Solar gains	128.9438	199.6200	278.7616	377.4744	434.9345	473.9059	447.0245	400.3674	334.1862	237.7832	158.5288	109.1501	(83)	
Total gains	682.9362	749.2099	806.9711	872.5710	896.1575	904.7941	860.1971	821.8213	774.7095	711.6309	669.3933	647.9921	(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	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9606	0.9453	0.9114	0.8364	0.7023	0.4897	0.3331	0.3567	0.6218	0.8472	0.9361	0.9655 (86)
MIT	19.5227	19.7051	20.0426	20.4521	20.7806	20.9556	20.9914	20.9892	20.8936	20.5177	19.9807	19.4965 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9526	0.9344	0.8930	0.8021	0.6398	0.3965	0.2216	0.2423	0.5328	0.8075	0.9212	0.9584 (89)
MIT 2	17.9961	18.2599	18.7378	19.3046	19.7210	19.9121	19.9344	19.9384	19.8597	19.4078	18.6669	17.9665 (90)
Living area fraction									fLA = Living area / (4) =			0.2066 (91)
MIT	18.3114	18.5584	19.0073	19.5416	19.9399	20.1277	20.1528	20.1554	20.0732	19.6371	18.9383	18.2826 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1614	18.4084	18.8573	19.3916	19.7899	19.9777	20.0028	20.0054	19.9232	19.4871	18.7883	18.1326 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9349	0.9143	0.8704	0.7819	0.6309	0.4000	0.2287	0.2494	0.5313	0.7876	0.9003	0.9419	(94)
Useful gains	638.4873	684.9833	702.3979	682.2830	565.3615	361.9298	196.7181	204.9576	411.6285	560.4475	602.6303	610.3722	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1257.1723	1225.2673	1096.0233	900.0985	643.8907	373.2013	197.7963	206.4075	443.1541	743.8581	1017.4778	1239.4069	(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	460.3016	363.0709	292.8573	156.8272	58.4257	0.0000	0.0000	0.0000	0.0000	136.4575	298.6902	468.0019	(98)
Space heating												2234.6322	(98)
Space heating per m2												28.0099	(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													2469.2069 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.3016	363.0709	292.8573	156.8272	58.4257	0.0000	0.0000	0.0000	0.0000	136.4575	298.6902	468.0019	(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)	508.6206	401.1833	323.5993	173.2897	64.5588	0.0000	0.0000	0.0000	0.0000	150.7817	330.0444	517.1291	(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	138.7176	105.0925	83.4439	39.8847	16.5893	0.0000	0.0000	16.3893	39.6451	83.1613	116.1870	138.4756	(64)
Efficiency of water heater	89.7383	89.7614	89.7703	89.8324	89.7723	87.3000	87.3000	87.3000	87.3000	89.2611	89.5804	87.3000	(216)
(217)m	89.7383	89.7614	89.7703	89.8324	89.7723	87.3000	87.3000	87.3000	87.3000	89.2611	89.5804	87.3000	(217)
Fuel for water heating, kWh/month	154.5802	117.0798	92.9527	44.3991	18.4793	0.0000	0.0000	18.7735	45.4125	93.1664	129.7014	154.2923	(219)
Water heating fuel used												868.8372	(219)
Annual totals kWh/year													
Space heating fuel - main system												2469.2069	(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 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												1995.7971	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2469.2069	9.7400	240.5008	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	868.8372	9.7400	84.6247	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	356.9126	36.8500	131.5223	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			-65.4925	(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	2469.2069	0.2160	533.3487	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	868.8372	0.2160	187.6688	(264)
Space and water heating			721.0175	(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				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			24.3913 (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	2469.2069	1.2200	3012.4324 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	868.8372	1.2200	1059.9814 (264)
Space and water heating			4072.4138 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-48.2845 (272)
Primary energy kWh/m2/year			-0.6052 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
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	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
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	3.0000	81.1852	0.4600	0.0000	0.9000	100.8320
South	5.0600	112.2060	0.4600	0.0000	0.9000	235.0536
West	0.7200	117.5071	0.4600	0.0000	0.9000	35.0265
North	4.5100	81.1852	0.4600	0.0000	0.9000	151.5841

total: 522.4962

	Jun	Jul	Aug	
Solar gains	554	522	468	(P4)
Internal gains	428	410	418	
Total summer gains	982	933	886	(P5)

	2.99	2.84	2.70	
Summer gain/loss ratio	2.99	2.84	2.70	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 150.8)	0.94	0.94	0.94	
Threshold temperature	19.94	21.69	21.45	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight