

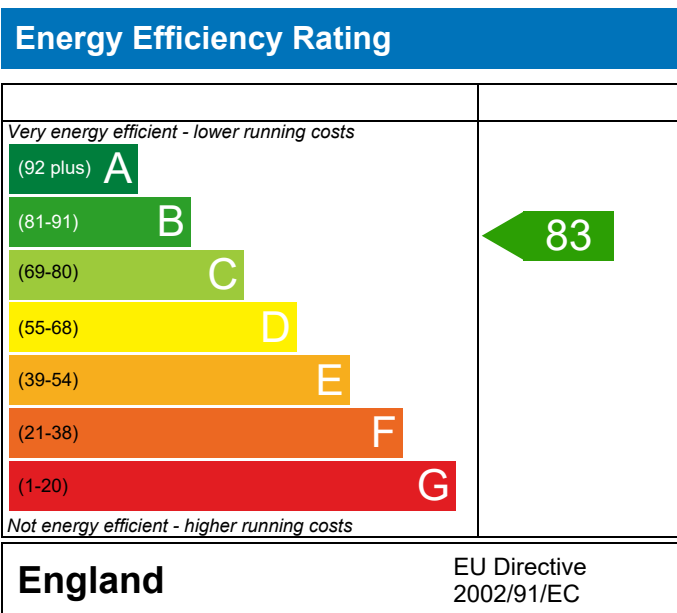
# PREDICTED ENERGY ASSESSMENT

Plot 219

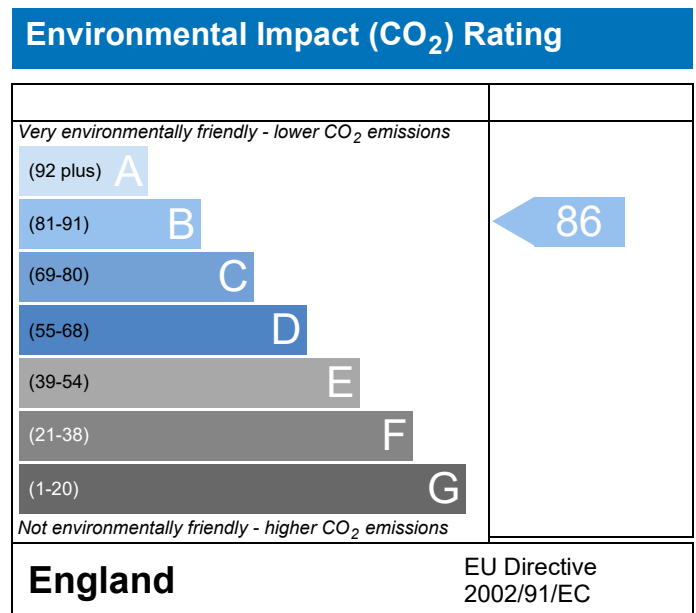
Dwelling type: House, Semi-Detached  
 Date of assessment: 16/05/2022  
 Produced by: Scott Binstead  
 Total floor area: 85.3 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	219			Issued on Date	16/05/2022
Assessment Reference	219 S	Prop Type Ref	3B5P		
Property	Plot 219				
SAP Rating	83 B	DER	18.14	TER	18.80
Environmental	86 B	% DER<TER	3.53		
CO <sub>2</sub> Emissions (t/year)	1.28	DFEE	47.21	TFEE	53.55
General Requirements Compliance	Pass	% DFEE<TFEE	11.84		
Assessor Details	Chris Nicholls, , Tel: ,			Assessor ID	U903-0001
Client					

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 85 m<sup>2</sup>

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 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 18.14 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.6 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)47.2 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 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 30

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: Programmer, room thermostat and TRVs 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 East:

4.68 m<sup>2</sup>, No overhang

Windows facing West:

3.55 m<sup>2</sup>, No overhang

Air change rate:

3.87 ach

Blinds/curtains:

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

10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K

Roof U-value 0.11 W/m<sup>2</sup>K

Roof U-value 0.11 W/m<sup>2</sup>K

Door U-value 1.00 W/m<sup>2</sup>K

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3879 (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) =	0.3588 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4575	0.4485	0.4395	0.3947	0.3857	0.3409	0.3409	0.3319	0.3588	0.3857	0.4036	0.4216 (22b)
Effective ac	0.6046	0.6006	0.5966	0.5779	0.5744	0.5581	0.5581	0.5551	0.5644	0.5744	0.5815	0.5889 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.5708	43.2780	42.9910	41.6430	41.3908	40.2168	40.2168	39.9994	40.6690	41.3908	41.9010	42.4345 (38)
Average = Sum(39)m / 12 =	99.8340	99.5412	99.2542	97.9062	97.6540	96.4799	96.4799	96.2625	96.9322	97.6540	98.1642	98.6976 (39)
HLP	1.1704	1.1670	1.1636	1.1478	1.1448	1.1311	1.1311	1.1285	1.1364	1.1448	1.1508	1.1571 (40)
HLP (average)												1.1478 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883	(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	14.6813	13.2473	14.6226	14.0981	14.5297	14.0167	14.4564	14.5039	14.0611	14.5842	14.1725	14.6667	(61)	
Total heat required for water heating calculated for each month	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)	
Total per year (kWh/year) = Sum(64)m =	1664.7819 (64)													
Heat gains from water heating, kWh/month	55.1436	48.3307	50.1111	44.0255	42.4941	37.0388	34.6889	39.2847	39.5999	45.6992	49.4474	53.5158	(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	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	127.7888	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.7330	21.0794	17.1429	12.9783	9.7014	8.1904	8.8500	11.5035	15.4400	19.6047	22.8815	24.3926	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.1606	232.5490	226.5304	213.7176	197.5438	182.3426	172.1873	169.7990	175.8176	188.6303	204.8042	220.0053	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	35.7789	(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)	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	(71)
Water heating gains (Table 5)	74.1177	71.9206	67.3536	61.1465	57.1157	51.4428	46.6248	52.8021	54.9999	61.4237	68.6770	71.9298	(72)
Total internal gains	392.3480	389.8857	375.3636	352.1791	328.6975	306.3124	291.9988	298.4412	310.5941	333.9953	360.6994	380.6644	(73)

#### 6. Solar gains

[Jan]		Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East		4.6810	19.6403	0.7600	0.7200	0.7700	34.8630 (76)						
West		3.5470	19.6403	0.7600	0.7200	0.7700	26.4173 (80)						
Solar gains	61.2803	119.8773	197.4208	287.9265	352.8647	361.2198	343.8960	295.4016	229.6086	142.2445	76.4093	50.3939	(83)
Total gains	453.6283	509.7630	572.7844	640.1056	681.5622	667.5322	635.8948	593.8428	540.2026	476.2398	437.1087	431.0583	(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	30.8170	30.9076	30.9970	31.4237	31.5049	31.8883	31.8883	31.9603	31.7395	31.5049	31.3412	31.1718	
alpha	3.0545	3.0605	3.0665	3.0949	3.1003	3.1259	3.1259	3.1307	3.1160	3.1003	3.0894	3.0781	
util living area	0.9863	0.9793	0.9634	0.9256	0.8519	0.7273	0.5902	0.6379	0.8310	0.9469	0.9796	0.9882	(86)
MIT	18.8469	19.0504	19.4306	19.9478	20.4174	20.7644	20.9122	20.8857	20.6079	19.9958	19.3379	18.8167	(87)
Th 2	19.9438	19.9465	19.9492	19.9620	19.9644	19.9755	19.9755	19.9776	19.9712	19.9644	19.9596	19.9545	(88)
util rest of house	0.9836	0.9753	0.9560	0.9091	0.8158	0.6552	0.4792	0.5305	0.7764	0.9319	0.9750	0.9860	(89)
MIT 2	17.9747	18.1786	18.5567	19.0716	19.5180	19.8305	19.9381	19.9251	19.7044	19.1274	18.4751	17.9523	(90)
Living area fraction													fLA = Living area / (4) = 0.2243 (91)
MIT	18.1703	18.3742	18.7527	19.2681	19.7197	20.0399	20.1566	20.1406	19.9070	19.3221	18.6686	18.1461	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.0203	18.2242	18.6027	19.1181	19.5697	19.8899	20.0066	19.9906	19.7570	19.1721	18.5186	17.9961	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9769	0.9663	0.9432	0.8923	0.7994	0.6484	0.4829	0.5320	0.7627	0.9167	0.9660	0.9800	(94)
Useful gains	443.1329	492.5922	540.2567	571.1438	544.8705	432.8403	307.0718	315.9191	411.9996	436.5913	422.2569	422.4360	(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	1369.7483	1326.3029	1201.2457	1000.4178	768.5068	510.3725	328.6674	345.6354	548.3444	837.1037	1120.8989	1361.6464	(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	689.4018	560.2536	491.7758	309.0772	166.3854	0.0000	0.0000	0.0000	0.0000	297.9812	503.0223	698.7726	(98)
Space heating													3716.6699 (98)
Space heating per m <sup>2</sup>													(98) / (4) = 43.5717 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													4106.8176 (211)
Space heating requirement	689.4018	560.2536	491.7758	309.0772	166.3854	0.0000	0.0000	0.0000	0.0000	297.9812	503.0223	698.7726	(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)	761.7699	619.0647	543.3987	341.5218	183.8513	0.0000	0.0000	0.0000	0.0000	329.2610	555.8257	772.1244	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)
Efficiency of water heater (217)m	89.8501	89.8097	89.7145	89.4981	89.0595	87.3000	87.3000	87.3000	87.3000	89.4466	89.7358	87.3000	(216)
Fuel for water heating, kWh/month	188.6344	165.5080	172.0327	151.8531	147.5495	131.5839	123.6132	139.4597	140.4196	157.7029	169.6430	183.1370	(219)
Water heating fuel used													1871.1369 (219)
Annual totals kWh/year													
Space heating fuel - main system													4106.8176 (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)													419.1320 (232)
Total delivered energy for all uses													6472.0864 (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	4106.8176	0.2160	887.0726	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1871.1369	0.2160	404.1656	(264)
Space and water heating			1291.2382	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	419.1320	0.5190	217.5295	(268)
Total CO2, kg/year			1547.6926	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.1400	(273)

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

DER			18.1400	ZC1
Total Floor Area		TFA	85.3000	
Assumed number of occupants		N	2.5558	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.9893	ZC2
CO2 emissions from cooking, equation (L16)			2.1142	ZC3
Total CO2 emissions			36.2434	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			36.2434	ZC8

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3874 (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) =	0.3583 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4569	0.4479	0.4390	0.3942	0.3852	0.3404	0.3404	0.3315	0.3583	0.3852	0.4031	0.4210 (22b)
Effective ac	0.6044	0.6003	0.5963	0.5777	0.5742	0.5579	0.5579	0.5549	0.5642	0.5742	0.5813	0.5886 (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			4.3000	1.0000	4.3000		(26)					
TER Opening Type (Uw = 1.40)			8.2300	1.3258	10.9110		(27)					
Flr - Ground			42.6470	0.1300	5.5441		(28a)					
Wl - Brick	95.1070	12.5240	82.5830	0.1800	14.8649		(29a)					
RF - Ins Joist	42.6470		42.6470	0.1300	5.5441		(30)					
RF - Joist over Bay	1.5700		1.5700	0.1300	0.2041		(30)					
Total net area of external elements Aum(A, m2)			181.9770				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.3682	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2162 (36)					
Total fabric heat loss							(33) + (36) = 50.5844 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5514	Feb 43.2594	Mar 42.9731	Apr 41.6286	May 41.3770	Jun 40.2060	Jul 40.2060	Aug 39.9891	Sep 40.6571	Oct 41.3770	Nov 41.8859	Dec 42.4180 (38)
Heat transfer coeff	94.1358	93.8438	93.5576	92.2130	91.9615	90.7904	90.7904	90.5736	91.2415	91.9615	92.4704	93.0024 (39)
Average = Sum(39)m / 12 =												92.2118 (39)
HLP	Jan 1.1036	Feb 1.1002	Mar 1.0968	Apr 1.0810	May 1.0781	Jun 1.0644	Jul 1.0644	Aug 1.0618	Sep 1.0697	Oct 1.0781	Nov 1.0841	Dec 1.0903 (40)
HLP (average)												1.0810 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (45)
Energy content (annual)												Total = Sum(45)m = 1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)





# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As 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													3810.6420 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	668.1105	543.4709	475.5268	290.4502	140.4450	0.0000	0.0000	0.0000	0.0000	279.5149	484.6642	676.9571	(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)	715.3217	581.8746	509.1293	310.9745	150.3694	0.0000	0.0000	0.0000	0.0000	299.2665	518.9124	724.7934	(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	205.7657	181.4224	189.0426	167.6712	162.3353	142.9759	136.9818	152.7026	154.3891	175.8027	187.3732	200.8810	(64)
Efficiency of water heater (217)m	87.7997	87.6411	87.2773	86.4216	84.6889	80.3000	80.3000	80.3000	80.3000	86.2131	87.3372	80.3000	(216)
Fuel for water heating, kWh/month	234.3581	207.0060	216.5999	194.0154	191.6843	178.0522	170.5876	190.1652	192.2653	203.9164	214.5399	228.6094	(219)
Water heating fuel used												2421.7997	(219)
Annual totals kWh/year													
Space heating fuel - main system													3810.6420 (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)													421.5982 (232)
Total delivered energy for all uses													6729.0398 (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	3810.6420	0.2160	823.0987 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2421.7997	0.2160	523.1087 (264)
Space and water heating			1346.2074 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	421.5982	0.5190	218.8095 (268)
Total CO2, kg/m2/year			1603.9419 (272)
Emissions per m2 for space and water heating			15.7820 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5652 (272b)
Emissions per m2 for pumps and fans			0.4563 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7820 * 1.00) + 2.5652 + 0.4563, 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3879 (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) =	0.3588 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4575	0.4485	0.4395	0.3947	0.3857	0.3409	0.3409	0.3319	0.3588	0.3857	0.4036	0.4216 (22b)
Effective ac	0.6046	0.6006	0.5966	0.5779	0.5744	0.5581	0.5581	0.5551	0.5644	0.5744	0.5815	0.5889 (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
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m2)			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.5708	43.2780	42.9910	41.6430	41.3908	40.2168	40.2168	39.9994	40.6690	41.3908	41.9010	42.4345 (38)
Average = Sum(39)m / 12 =	99.8340	99.5412	99.2542	97.9062	97.6540	96.4799	96.4799	96.2625	96.9322	97.6540	98.1642	98.6976 (39)
HLP	1.1704	1.1670	1.1636	1.1478	1.1448	1.1311	1.1311	1.1285	1.1364	1.1448	1.1508	1.1571 (40)
HLP (average)												1.1478 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	663.7624	573.9217	565.6398	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	848.6066	811.7766	762.1016	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	133.0878	176.9640	146.1676	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												456.2194 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	33.2719	44.2410	36.5419	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												114.0549 (107)
Space cooling per m2												1.3371 (108)
Energy for space heating												45.8756 (99)
Energy for space cooling												1.3371 (108)
Total												47.2128 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.2 (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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3874 (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) =	0.3583 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4569	0.4479	0.4390	0.3942	0.3852	0.3404	0.3404	0.3315	0.3583	0.3852	0.4031	0.4210 (22b)
Effective ac	0.6044	0.6003	0.5963	0.5777	0.5742	0.5579	0.5579	0.5549	0.5642	0.5742	0.5813	0.5886 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
TER Opaque door			4.3000	1.0000	4.3000		(26)					
TER Opening Type (Uw = 1.40)			8.2300	1.3258	10.9110		(27)					
Flr - Ground			42.6470	0.1300	5.5441		(28a)					
Wl - Brick	95.1070	12.5240	82.5830	0.1800	14.8649		(29a)					
RF - Ins Joist	42.6470		42.6470	0.1300	5.5441		(30)					
RF - Joist over Bay	1.5700		1.5700	0.1300	0.2041		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			181.9770				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	41.3682	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2162 (36)					
Total fabric heat loss							(33) + (36) = 50.5844 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.5514	Feb 43.2594	Mar 42.9731	Apr 41.6286	May 41.3770	Jun 40.2060	Jul 40.2060	Aug 39.9891	Sep 40.6571	Oct 41.3770	Nov 41.8859	Dec 42.4180 (38)
Heat transfer coeff	94.1358	93.8438	93.5576	92.2130	91.9615	90.7904	90.7904	90.5736	91.2415	91.9615	92.4704	93.0024 (39)
Average = Sum(39)m / 12 =												92.2118 (39)
HLP	Jan 1.1036	Feb 1.1002	Mar 1.0968	Apr 1.0810	May 1.0781	Jun 1.0644	Jul 1.0644	Aug 1.0618	Sep 1.0697	Oct 1.0781	Nov 1.0841	Dec 1.0903 (40)
HLP (average)												1.0810 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (45)
Energy content (annual)												Total = Sum(45)m = 1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	16.0218	26.8827	20.8804	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling													63.7849 (107)
Space cooling per m2													0.7478 (108)
Energy for space heating													45.8198 (99)
Energy for space cooling													0.7478 (108)
Total													46.5675 (109)
Target Fabric Energy Efficiency (TFEE)													53.6 (109)

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# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3879 (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) =	0.3588 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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 infltr rate	0.3767	0.3588	0.3588	0.3319	0.3319	0.2960	0.3050	0.2870	0.2960	0.3139	0.3139	0.3409 (22b)
Effective ac	0.5710	0.5644	0.5644	0.5551	0.5551	0.5438	0.5465	0.5412	0.5438	0.5493	0.5493	0.5581 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.1444	40.6690	40.6690	39.9994	39.9994	39.1877	39.3819	38.9992	39.1877	39.5819	39.5819	40.2168 (38)
Average = Sum(39)m / 12 =	97.4076	96.9322	96.9322	96.2625	96.2625	95.4508	95.6450	95.2624	95.4508	95.8451	95.8451	96.4799 (39)
HLP	1.1419	1.1364	1.1364	1.1285	1.1285	1.1190	1.1213	1.1168	1.1190	1.1236	1.1236	1.1311 (40)
HLP (average)												1.1272 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (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 =	1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883	(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	14.6813	13.2473	14.6226	14.0981	14.5297	14.0167	14.4564	14.5039	14.0611	14.5842	14.1725	14.6667	(61)	
Total heat required for water heating calculated for each month	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)	
Total per year (kWh/year) = Sum(64)m =													1664.7819 (64)	
RHI water heating demand													1665 (64)	
Heat gains from water heating, kWh/month	55.1436	48.3307	50.1111	44.0255	42.4941	37.0388	34.6889	39.2847	39.5999	45.6992	49.4474	53.5158	(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	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.3325	52.6986	42.8574	32.4458	24.2536	20.4759	22.1249	28.7588	38.6001	49.0116	57.2038	60.9815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.5234	347.0881	338.1051	318.9815	294.8415	272.1532	256.9960	253.4313	262.4143	281.5378	305.6779	328.3662	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	(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)	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	(71)
Water heating gains (Table 5)	74.1177	71.9206	67.3536	61.1465	57.1157	51.4428	46.6248	52.8021	54.9999	61.4237	68.6770	71.9298	(72)
Total internal gains	583.9795	578.7132	555.3220	519.5798	483.2167	451.0779	432.7517	441.9982	463.0201	498.9791	538.5647	568.2835	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
East	4.6810	22.3313	0.7600	0.7200	0.7700	39.6399 (76)							
West	3.5470	22.3313	0.7600	0.7200	0.7700	30.0369 (80)							
Solar gains	69.6768	122.6063	199.0910	298.3804	355.5328	389.1957	366.6381	322.5546	250.7098	155.2523	89.0035	56.7428	(83)
Total gains	653.6563	701.3195	754.4131	817.9602	838.7495	840.2736	799.3898	764.5528	713.7299	654.2313	627.5682	625.0263	(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	31.5846	31.7395	31.7395	31.9603	31.9603	32.2321	32.1666	32.2959	32.2321	32.0995	32.0995	31.8883	
alpha	3.1056	3.1160	3.1160	3.1307	3.1307	3.1488	3.1444	3.1531	3.1488	3.1400	3.1400	3.1259	
util living area	0.9592	0.9473	0.9165	0.8480	0.7246	0.5223	0.3604	0.3852	0.6556	0.8634	0.9388	0.9633	(86)
MIT	19.3592	19.5231	19.8824	20.3301	20.7100	20.9312	20.9850	20.9815	20.8465	20.3986	19.8246	19.3359	(87)
Th 2	19.9667	19.9712	19.9712	19.9776	19.9776	19.9853	19.9835	19.9871	19.9853	19.9816	19.9816	19.9755	(88)
util rest of house	0.9518	0.9378	0.9007	0.8182	0.6683	0.4315	0.2469	0.2692	0.5729	0.8299	0.9259	0.9566	(89)
MIT 2	18.4965	18.6603	19.0102	19.4400	19.7790	19.9534	19.9801	19.9826	19.8996	19.5156	18.9664	18.4805	(90)
Living area fraction													fLA = Living area / (4) =
MIT	18.6900	18.8538	19.2058	19.6396	19.9878	20.1727	20.2055	20.2066	20.1120	19.7136	19.1588	18.6723	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.5400	18.7038	19.0558	19.4896	19.8378	20.0227	20.0555	20.0566	19.9620	19.5636	19.0088	18.5223	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	613.4798	647.2802	666.5287	655.6882	553.3506	365.5460	203.9928	212.1286	407.4220	532.1326	571.2625	590.1275	(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	1309.1590	1270.1762	1129.8223	923.1231	658.2217	383.9676	206.1584	214.9720	454.5331	763.2725	1055.1433	1294.9838	(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	517.5853	418.5861	344.6905	192.5532	78.0241	0.0000	0.0000	0.0000	0.0000	171.9681	348.3942	524.4131	(98)
Space heating													2596.2146 (98)
RHI space heating demand													2596 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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) =	0.1374 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3879 (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) =	0.3588 (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	0.4575	0.4485	0.4395	0.3947	0.3857	0.3409	0.3409	0.3319	0.3588	0.3857	0.4036	0.4216 (22b)
Effective ac	0.6046	0.6006	0.5966	0.5779	0.5744	0.5581	0.5581	0.5551	0.5644	0.5744	0.5815	0.5889 (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
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m2)			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.5708	43.2780	42.9910	41.6430	41.3908	40.2168	40.2168	39.9994	40.6690	41.3908	41.9010	42.4345 (38)
Average = Sum(39)m / 12 =	99.8340	99.5412	99.2542	97.9062	97.6540	96.4799	96.4799	96.2625	96.9322	97.6540	98.1642	98.6976 (39)
HLP	1.1704	1.1670	1.1636	1.1478	1.1448	1.1311	1.1311	1.1285	1.1364	1.1448	1.1508	1.1571 (40)
HLP (average)												1.1478 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (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 =	1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883	(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	14.6813	13.2473	14.6226	14.0981	14.5297	14.0167	14.4564	14.5039	14.0611	14.5842	14.1725	14.6667	(61)	
Total heat required for water heating calculated for each month	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)	
Total per year (kWh/year) = Sum(64)m =	1664.7819 (64)													
Heat gains from water heating, kWh/month	55.1436	48.3307	50.1111	44.0255	42.4941	37.0388	34.6889	39.2847	39.5999	45.6992	49.4474	53.5158	(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	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.3325	52.6986	42.8574	32.4458	24.2536	20.4759	22.1249	28.7588	38.6001	49.0116	57.2038	60.9815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.5234	347.0881	338.1051	318.9815	294.8415	272.1532	256.9960	253.4313	262.4143	281.5378	305.6779	328.3662	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	(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)	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	(71)
Water heating gains (Table 5)	74.1177	71.9206	67.3536	61.1465	57.1157	51.4428	46.6248	52.8021	54.9999	61.4237	68.6770	71.9298	(72)
Total internal gains	583.9795	578.7132	555.3220	519.5798	483.2167	451.0779	432.7517	441.9982	463.0201	498.9791	538.5647	568.2835	(73)

#### 6. Solar gains

[Jan]		Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East		4.6810	19.6403	0.7600	0.7200	0.7700	34.8630 (76)						
West		3.5470	19.6403	0.7600	0.7200	0.7700	26.4173 (80)						
Solar gains	61.2803	119.8773	197.4208	287.9265	352.8647	361.2198	343.8960	295.4016	229.6086	142.2445	76.4093	50.3939	(83)
Total gains	645.2598	698.5905	752.7428	807.5063	836.0814	812.2977	776.6477	737.3997	692.6287	641.2236	614.9740	618.6774	(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	30.8170	30.9076	30.9970	31.4237	31.5049	31.8883	31.8883	31.9603	31.7395	31.5049	31.3412	31.1718	
alpha	3.0545	3.0605	3.0665	3.0949	3.1003	3.1259	3.1259	3.1307	3.1160	3.1003	3.0894	3.0781	
util living area	0.9655	0.9540	0.9296	0.8772	0.7864	0.6460	0.5057	0.5452	0.7437	0.8956	0.9513	0.9693	(86)
MIT	19.1568	19.3459	19.6922	20.1537	20.5542	20.8344	20.9433	20.9271	20.7259	20.2151	19.6163	19.1244	(87)
Th 2	19.9438	19.9465	19.9492	19.9620	19.9644	19.9755	19.9755	19.9776	19.9712	19.9644	19.9596	19.9545	(88)
util rest of house	0.9594	0.9459	0.9166	0.8534	0.7426	0.5711	0.4028	0.4430	0.6784	0.8703	0.9413	0.9639	(89)
MIT 2	18.2798	18.4677	18.8086	19.2621	19.6333	19.8778	19.9526	19.9460	19.7943	19.3306	18.7462	18.2558	(90)
Living area fraction	fLA = Living area / (4) =												0.2243 (91)
MIT	18.4765	18.6646	19.0068	19.4620	19.8398	20.0924	20.1748	20.1660	20.0032	19.5290	18.9413	18.4506	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.3265	18.5146	18.8568	19.3120	19.6898	19.9424	20.0248	20.0160	19.8532	19.3790	18.7913	18.3006	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9471	0.9316	0.8998	0.8356	0.7294	0.5685	0.4080	0.4472	0.6698	0.8528	0.9267	0.9525	(94)	
Useful gains	611.1505	650.8081	677.3077	674.7887	609.8246	461.7671	316.8954	329.7379	463.9560	546.8519	569.9269	589.2615	(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	1400.3204	1355.2164	1226.4614	1019.4014	780.2384	515.4304	330.4217	348.0880	557.6712	857.3008	1147.6703	1391.6994	(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	587.1424	473.3623	408.5704	248.1212	126.7879	0.0000	0.0000	0.0000	0.0000	230.9740	415.9753	597.0138	(98)	
Space heating													3087.9473 (98)	
Space heating per m <sup>2</sup>													(98) / (4) =	36.2010 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3412.0964 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	587.1424	473.3623	408.5704	248.1212	126.7879	0.0000	0.0000	0.0000	0.0000	230.9740	415.9753	597.0138	(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)	648.7761	523.0523	451.4590	274.1671	140.0971	0.0000	0.0000	0.0000	0.0000	255.2199	459.6412	659.6838	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)
Efficiency of water heater (217)m	89.7630	89.7141	89.5995	89.3411	88.8426	87.3000	87.3000	87.3000	87.3000	89.2595	89.6199	87.3000	(216)
Fuel for water heating, kWh/month	188.8175	165.6844	172.2534	152.1199	147.9097	131.5839	123.6132	139.4597	140.4196	158.0335	169.8625	183.3068	(219)
Water heating fuel used													1873.0639 (219)
Annual totals kWh/year													
Space heating fuel - main system													3412.0964 (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)													419.1320 (232)
Total delivered energy for all uses													5779.2923 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3412.0964	3.4800	118.7410 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1873.0639	3.4800	65.1826 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	419.1320	13.1900	55.2835 (250)
Additional standing charges			120.0000 (251)
Total energy cost			369.0996 (255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1897 (257)
SAP value		83.4033
SAP rating (Section 12)		83 (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	3412.0964	0.2160	737.0128 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1873.0639	0.2160	404.5818 (264)
Space and water heating			1141.5946 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	419.1320	0.5190	217.5295 (268)
Total kg/year			1398.0491 (272)
CO2 emissions per m2			16.3900 (273)
EI value			85.6225
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	$3.48 / 0.8876 = 3.921$ , stars = 4
Water heating environmental impact	$0.216 / 0.8876 = 0.2434$ , 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3879 (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) =	0.3588 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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 inflt rate	0.3767	0.3588	0.3588	0.3319	0.3319	0.2960	0.3050	0.2870	0.2960	0.3139	0.3139	0.3409 (22b)
Effective ac	0.5710	0.5644	0.5644	0.5551	0.5551	0.5438	0.5465	0.5412	0.5438	0.5493	0.5493	0.5581 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.1444	40.6690	40.6690	39.9994	39.9994	39.1877	39.3819	38.9992	39.1877	39.5819	39.5819	40.2168 (38)
Average = Sum(39)m / 12 =	97.4076	96.9322	96.9322	96.2625	96.2625	95.4508	95.6450	95.2624	95.4508	95.8451	95.8451	96.4799 (39)
HLP	1.1419	1.1364	1.1364	1.1285	1.1285	1.1190	1.1213	1.1168	1.1190	1.1236	1.1236	1.1311 (40)
HLP (average)												1.1272 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (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 =	1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883	(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	14.6813	13.2473	14.6226	14.0981	14.5297	14.0167	14.4564	14.5039	14.0611	14.5842	14.1725	14.6667	(61)	
Total heat required for water heating calculated for each month	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)	
Total per year (kWh/year) = Sum(64)m =	1664.7819 (64)													
Heat gains from water heating, kWh/month	55.1436	48.3307	50.1111	44.0255	42.4941	37.0388	34.6889	39.2847	39.5999	45.6992	49.4474	53.5158	(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	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.3325	52.6986	42.8574	32.4458	24.2536	20.4759	22.1249	28.7588	38.6001	49.0116	57.2038	60.9815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.5234	347.0881	338.1051	318.9815	294.8415	272.1532	256.9960	253.4313	262.4143	281.5378	305.6779	328.3662	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	(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)	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	(71)
Water heating gains (Table 5)	74.1177	71.9206	67.3536	61.1465	57.1157	51.4428	46.6248	52.8021	54.9999	61.4237	68.6770	71.9298	(72)
Total internal gains	583.9795	578.7132	555.3220	519.5798	483.2167	451.0779	432.7517	441.9982	463.0201	498.9791	538.5647	568.2835	(73)

#### 6. Solar gains

[Jan]		Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
East		4.6810	22.3313	0.7600		0.7200		0.7700	39.6399 (76)				
West		3.5470	22.3313	0.7600		0.7200		0.7700	30.0369 (80)				
Solar gains	69.6768	122.6063	199.0910	298.3804	355.5328	389.1957	366.6381	322.5546	250.7098	155.2523	89.0035	56.7428	(83)
Total gains	653.6563	701.3195	754.4131	817.9602	838.7495	840.2736	799.3898	764.5528	713.7299	654.2313	627.5682	625.0263	(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	31.5846	31.7395	31.7395	31.9603	31.9603	32.2321	32.1666	32.2959	32.2321	32.0995	32.0995	31.8883	
alpha	3.1056	3.1160	3.1160	3.1307	3.1307	3.1488	3.1444	3.1531	3.1488	3.1400	3.1400	3.1259	
util living area	0.9592	0.9473	0.9165	0.8480	0.7246	0.5223	0.3604	0.3852	0.6556	0.8634	0.9388	0.9633	(86)
MIT	19.3592	19.5231	19.8824	20.3301	20.7100	20.9312	20.9850	20.9815	20.8465	20.3986	19.8246	19.3359	(87)
Th 2	19.9667	19.9712	19.9712	19.9776	19.9776	19.9853	19.9835	19.9871	19.9853	19.9816	19.9816	19.9755	(88)
util rest of house	0.9518	0.9378	0.9007	0.8182	0.6683	0.4315	0.2469	0.2692	0.5729	0.8299	0.9259	0.9566	(89)
MIT 2	18.4965	18.6603	19.0102	19.4400	19.7790	19.9534	19.9801	19.9826	19.8996	19.5156	18.9664	18.4805	(90)
Living area fraction													fLA = Living area / (4) = 0.2243 (91)
MIT	18.6900	18.8538	19.2058	19.6396	19.9878	20.1727	20.2055	20.2066	20.1120	19.7136	19.1588	18.6723	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.5400	18.7038	19.0558	19.4896	19.8378	20.0227	20.0555	20.0566	19.9620	19.5636	19.0088	18.5223	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9385	0.9229	0.8835	0.8016	0.6597	0.4350	0.2552	0.2775	0.5708	0.8134	0.9103	0.9442	(94)
Useful gains	613.4798	647.2802	666.5287	655.6882	553.3506	365.5460	203.9928	212.1286	407.4220	532.1326	571.2625	590.1275	(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	1309.1590	1270.1762	1129.8223	923.1231	658.2217	383.9676	206.1584	214.9720	454.5331	763.2725	1055.1433	1294.9838	(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	517.5853	418.5861	344.6905	192.5532	78.0241	0.0000	0.0000	0.0000	0.0000	171.9681	348.3942	524.4131	(98)
Space heating													2596.2146 (98)
Space heating per m <sup>2</sup>													(98) / (4) = 30.4363 (99)

#### 8c. Space cooling requirement



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2868.7454 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	517.5853	418.5861	344.6905	192.5532	78.0241	0.0000	0.0000	0.0000	0.0000	171.9681	348.3942	524.4131	(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)	571.9175	462.5261	380.8734	212.7659	86.2145	0.0000	0.0000	0.0000	0.0000	190.0200	384.9660	579.4620	(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	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(64)
Efficiency of water heater (217)m	89.6890	89.6390	89.4855	89.1479	88.4654	87.3000	87.3000	87.3000	87.3000	89.0294	89.5024	89.7144	(216)
Fuel for water heating, kWh/month	188.9731	165.8233	172.4728	152.4495	148.5404	131.5839	123.6132	139.4597	140.4196	158.4419	170.0855	183.4586	(219)
Water heating fuel used													1875.3214 (219)
Annual totals kWh/year													
Space heating fuel - main system													2868.7454 (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)													419.1320 (232)
Total delivered energy for all uses													5238.1988 (238)

#### 10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2868.7454	3.6300	104.1355 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1875.3214	3.6300	68.0742 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	419.1320	19.4400	81.4793 (250)
Additional standing charges			95.0000 (251)
Total energy cost			363.2689 (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	2868.7454	0.2160	619.6490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1875.3214	0.2160	405.0694 (264)
Space and water heating			1024.7184 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	419.1320	0.5190	217.5295 (268)
Total kg/year			1281.1729 (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	2868.7454	1.2200	3499.8694 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1875.3214	1.2200	2287.8921 (264)
Space and water heating			5787.7615 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	419.1320	3.0700	1286.7352 (268)
Primary energy kWh/year			7304.7467 (272)
Primary energy kWh/m2/year			85.6360 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83  
 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	-£ 26	-184 kg (14.4%)
U Solar photovoltaic panels	+ 10.2	-£ 355	-947 kg (86.3%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£26	2.16 kg/m <sup>2</sup>	B 85	B 87
Solar photovoltaic panels	£355	11.10 kg/m <sup>2</sup>	A 95	A 97
<b>Total Savings</b>	<b>£380</b>	<b>13.26 kg/m<sup>2</sup></b>		

Potential energy efficiency rating: A 95  
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)  
 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	£96	£106	-£10
Mains gas	£267	£232	£35
Space heating	£214	£214	£0
Water heating	£68	£42	£26
Lighting	£81	£81	£0
Generated (PV)	-£0	-£355	£355
<b>Total cost of fuels</b>	<b>£363</b>	<b>-£17</b>	<b>£380</b>
<b>Total cost of uses</b>	<b>£363</b>	<b>-£18</b>	<b>£381</b>
Delivered energy	61 kWh/m <sup>2</sup>	29 kWh/m <sup>2</sup>	32 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m <sup>2</sup>	15 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>	13 kg/m <sup>2</sup>
Primary energy	86 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>	78 kWh/m <sup>2</sup>

# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3879 (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) =	0.3588 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4575	0.4485	0.4395	0.3947	0.3857	0.3409	0.3409	0.3319	0.3588	0.3857	0.4036	0.4216 (22b)
Effective ac	0.6046	0.6006	0.5966	0.5779	0.5744	0.5581	0.5581	0.5551	0.5644	0.5744	0.5815	0.5889 (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
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m2)			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.5708	43.2780	42.9910	41.6430	41.3908	40.2168	40.2168	39.9994	40.6690	41.3908	41.9010	42.4345 (38)
Average = Sum(39)m / 12 =	99.8340	99.5412	99.2542	97.9062	97.6540	96.4799	96.4799	96.2625	96.9322	97.6540	98.1642	98.6976 (39)
HLP	1.1704	1.1670	1.1636	1.1478	1.1448	1.1311	1.1311	1.1285	1.1364	1.1448	1.1508	1.1571 (40)
HLP (average)												1.1478 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (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 =	1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883	(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	14.6813	13.2473	14.6226	14.0981	14.5297	14.0167	14.4564	14.5039	14.0611	14.5842	14.1725	14.6667	(61)	
Total heat required for water heating calculated for each month	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(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													1.2146 (H8)	
Utilisation factor													0.5610 (H9)	
Collector performance factor													0.8793 (H10)	
Dedicated solar storage volume													75.0000 (H11)	
Effective solar volume													75.0000 (H13)	
Daily hot water demand													94.8997 (H14)	
Volume ratio Veff/V													0.7903 (H15)	
Solar storage volume factor													0.9529 (H16)	
Solar input	-24.7221	-41.2540	-70.2603	-94.1627	-116.3301	-114.3710	-112.8596	-98.6060	-77.2282	-52.7378	-29.3239	-852.5440	(H17)	
Solar input (sum of months) = Sum(63)m =													-852.5440 (63)	
Output from w/h	144.7661	107.3883	84.0778	41.7428	15.0767	0.5018	0.0000	23.1423	45.3581	88.3221	122.9066	143.9007	(64)	
Total per year (kWh/year) = Sum(64)m =													817.1832 (64)	
Heat gains from water heating, kWh/month	55.1436	48.3307	50.1111	44.0255	42.4941	37.0388	34.6889	39.2847	39.5999	45.6992	49.4474	53.5158	(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	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.3325	52.6986	42.8574	32.4458	24.2536	20.4759	22.1249	28.7588	38.6001	49.0116	57.2038	60.9815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.5234	347.0881	338.1051	318.9815	294.8415	272.1532	256.9960	253.4313	262.4143	281.5378	305.6779	328.3662	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	(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)	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	(71)
Water heating gains (Table 5)	74.1177	71.9206	67.3536	61.1465	57.1157	51.4428	46.6248	52.8021	54.9999	61.4237	68.6770	71.9298	(72)
Total internal gains	583.9795	578.7132	555.3220	519.5798	483.2167	451.0779	432.7517	441.9982	463.0201	498.9791	538.5647	568.2835	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East		4.6810	19.6403	0.7600	0.7200	0.7700	34.8630 (76)						
West		3.5470	19.6403	0.7600	0.7200	0.7700	26.4173 (80)						
Solar gains	61.2803	119.8773	197.4208	287.9265	352.8647	361.2198	343.8960	295.4016	229.6086	142.2445	76.4093	50.3939	(83)
Total gains	645.2598	698.5905	752.7428	807.5063	836.0814	812.2977	776.6477	737.3997	692.6287	641.2236	614.9740	618.6774	(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	30.8170	30.9076	30.9970	31.4237	31.5049	31.8883	31.8883	31.9603	31.7395	31.5049	31.3412	31.1718	
alpha	3.0545	3.0605	3.0665	3.0949	3.1003	3.1259	3.1259	3.1307	3.1160	3.1003	3.0894	3.0781	
util living area	0.9655	0.9540	0.9296	0.8772	0.7864	0.6460	0.5057	0.5452	0.7437	0.8956	0.9513	0.9693	(86)
MIT	19.1568	19.3459	19.6922	20.1537	20.5542	20.8344	20.9433	20.9271	20.7259	20.2151	19.6163	19.1244	(87)
Th 2	19.9438	19.9465	19.9492	19.9620	19.9644	19.9755	19.9755	19.9776	19.9712	19.9644	19.9596	19.9545	(88)
util rest of house	0.9594	0.9459	0.9166	0.8534	0.7426	0.5711	0.4028	0.4430	0.6784	0.8703	0.9413	0.9639	(89)
MIT 2	18.2798	18.4677	18.8086	19.2621	19.6333	19.8778	19.9526	19.9460	19.7943	19.3306	18.7462	18.2558	(90)
Living area fraction													fLA = Living area / (4) =
MIT	18.4765	18.6646	19.0068	19.4620	19.8398	20.0924	20.1748	20.1660	20.0032	19.5290	18.9413	18.4506	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.3265	18.5146	18.8568	19.3120	19.6898	19.9424	20.0248	20.0160	19.8532	19.3790	18.7913	18.3006	(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	0.9471	0.9316	0.8998	0.8356	0.7294	0.5685	0.4080	0.4472	0.6698	0.8528	0.9267	0.9525	(94)
Useful gains	611.1505	650.8081	677.3077	674.7887	609.8246	461.7671	316.8954	329.7379	463.9560	546.8519	569.9269	589.2615	(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													
Month fracti	1400.3204	1355.2164	1226.4614	1019.4014	780.2384	515.4304	330.4217	348.0880	557.6712	857.3008	1147.6703	1391.6994	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	587.1424	473.3623	408.5704	248.1212	126.7879	0.0000	0.0000	0.0000	0.0000	230.9740	415.9753	597.0138	(98)
Space heating per m2											(98) / (4) =	3087.9473	(98)
												36.2010	(99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3412.0964	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	587.1424	473.3623	408.5704	248.1212	126.7879	0.0000	0.0000	0.0000	0.0000	230.9740	415.9753	597.0138	(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)	648.7761	523.0523	451.4590	274.1671	140.0971	0.0000	0.0000	0.0000	0.0000	255.2199	459.6412	659.6838	(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	144.7661	107.3883	84.0778	41.7428	15.0767	0.5018	0.0000	23.1423	45.3581	88.3221	122.9066	143.9007	(64)	
Efficiency of water heater	89.8486	89.8907	89.9374	90.0248	90.1488	87.3000	87.3000	87.3000	87.3000	89.5916	89.7497	89.8603	(217)	
Fuel for water heating, kWh/month	161.1223	119.4654	93.4849	46.3682	16.7242	0.5747	0.0000	26.5090	51.9565	98.5830	136.9438	160.1383	(219)	
Water heating fuel used												911.8701	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3412.0964	(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)													419.1320	(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													3140.8591	(238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3412.0964	3.4800	118.7410	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	911.8701	3.4800	31.7331	(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	419.1320	13.1900	55.2835	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit		-1727.2394	13.1900	-227.8229 (252)
Total energy cost			114.4222	(255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3688	(257)
SAP value		94.8550	
SAP rating (Section 12)		95	(258)
SAP band		A	

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

Energy Emission factor Emissions

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3412.0964	0.2160	737.0128 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	911.8701	0.2160	196.9639 (264)
Space and water heating			933.9768 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	419.1320	0.5190	217.5295 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			319.9440 (272)
CO2 emissions per m2			3.7500 (273)
EI value			96.7097
EI rating			97 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.6500 (1b)	2.4200 (2b)	103.2130 (1b) - (3b)
First floor	42.6500 (1c)	2.7000 (2c)	115.1550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.3680 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1374 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.3879 (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) =	0.3588 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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	0.3767	0.3588	0.3588	0.3319	0.3319	0.2960	0.3050	0.2870	0.2960	0.3139	0.3139	0.3409 (22b)
Effective ac	0.5710	0.5644	0.5644	0.5551	0.5551	0.5438	0.5465	0.5412	0.5438	0.5493	0.5493	0.5581 (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
Windows (Uw = 1.40)			8.2300	1.3258	10.9110		(27)
Solid Door			4.3000	1.0000	4.3000		(26)
Flr - Ground			42.6470	0.1500	6.3971	75.6000	3224.1132 (28a)
Wl - Brick	95.1070	12.5240	82.5830	0.2400	19.8199	38.9400	3215.7820 (29a)
RF - Ins Joist	42.6470		42.6470	0.1100	4.6912	5.8200	248.2055 (30)
RF - Joist over Bay	1.5700		1.5700	0.1100	0.1727	5.8200	9.1374 (30)
Total net area of external elements Aum(A, m2)			181.9770				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2918		(33)
Party Wall			42.8730	0.0000	0.0000	54.0300	2316.4282 (32)
Ground Floor Stud			79.6720			5.8200	463.6912 (32c)
1st Floor Stud			100.1106			5.8200	582.6437 (32c)
Internal Floor			42.6400			18.0000	767.5200 (32d)
Internal Ceiling			42.6400			5.8200	248.1648 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11075.6861 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							129.8439 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9713 (36)
Total fabric heat loss							(33) + (36) = 56.2632 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.1444	40.6690	40.6690	39.9994	39.9994	39.1877	39.3819	38.9992	39.1877	39.5819	39.5819	40.2168 (38)
Average = Sum(39)m / 12 =	97.4076	96.9322	96.9322	96.2625	96.2625	95.4508	95.6450	95.2624	95.4508	95.8451	95.8451	96.4799 (39)
HLP	1.1419	1.1364	1.1364	1.1285	1.1285	1.1190	1.1213	1.1168	1.1190	1.1236	1.1236	1.1311 (40)
HLP (average)												1.1272 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5558 (42)
Average daily hot water use (litres/day)												94.8997 (43)
Daily hot water use	104.3896	100.5937	96.7977	93.0017	89.2057	85.4097	85.4097	89.2057	93.0017	96.7977	100.5937	104.3896 (44)
Energy conte	154.8068	135.3950	139.7155	121.8074	116.8771	100.8561	93.4580	107.2444	108.5252	126.4757	138.0581	149.9221 (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 =	1493.1414 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.2210	20.3093	20.9573	18.2711	17.5316	15.1284	14.0187	16.0867	16.2788	18.9714	20.7087	22.4883	(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	14.6813	13.2473	14.6226	14.0981	14.5297	14.0167	14.4564	14.5039	14.0611	14.5842	14.1725	14.6667	(61)	
Total heat required for water heating calculated for each month	169.4882	148.6423	154.3382	135.9056	131.4068	114.8728	107.9143	121.7483	122.5863	141.0599	152.2306	164.5888	(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													1.2828 (H8)	
Utilisation factor													0.5414 (H9)	
Collector performance factor													0.8793 (H10)	
Dedicated solar storage volume													75.0000 (H11)	
Effective solar volume													75.0000 (H13)	
Daily hot water demand													94.8997 (H14)	
Volume ratio Veff/V													0.7903 (H15)	
Solar storage volume factor													0.9529 (H16)	
Solar input													-868.8807 (H17)	
Solar input	-26.7437	-40.1957	-67.6947	-93.5748	-112.6956	-118.6072	-115.7592	-103.3737	-80.6835	-54.8875	-32.5077	-22.1573	(63)	
													Solar input (sum of months) = Sum(63)m =	
													-868.8807 (63)	
Output from w/h	142.7444	108.4466	86.6435	42.3307	18.7112	0.0000	0.0000	18.3746	41.9028	86.1724	119.7229	142.4315	(64)	
													Total per year (kWh/year) = Sum(64)m =	
													807.4805 (64)	
Heat gains from water heating, kWh/month	55.1436	48.3307	50.1111	44.0255	42.4941	37.0388	34.6889	39.2847	39.5999	45.6992	49.4474	53.5158	(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	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	153.3465	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.3325	52.6986	42.8574	32.4458	24.2536	20.4759	22.1249	28.7588	38.6001	49.0116	57.2038	60.9815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.5234	347.0881	338.1051	318.9815	294.8415	272.1532	256.9960	253.4313	262.4143	281.5378	305.6779	328.3662	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	52.8904	(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)	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	-102.2310	(71)
Water heating gains (Table 5)	74.1177	71.9206	67.3536	61.1465	57.1157	51.4428	46.6248	52.8021	54.9999	61.4237	68.6770	71.9298	(72)
Total internal gains	583.9795	578.7132	555.3220	519.5798	483.2167	451.0779	432.7517	441.9982	463.0201	498.9791	538.5647	568.2835	(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						
East		4.6810	22.3313	0.7600	0.7200	0.7700	39.6399 (76)						
West		3.5470	22.3313	0.7600	0.7200	0.7700	30.0369 (80)						
Solar gains	69.6768	122.6063	199.0910	298.3804	355.5328	389.1957	366.6381	322.5546	250.7098	155.2523	89.0035	56.7428	(83)
Total gains	653.6563	701.3195	754.4131	817.9602	838.7495	840.2736	799.3898	764.5528	713.7299	654.2313	627.5682	625.0263	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)													21.0000 (85)
Utilisation factor for gains for living area, n <sub>l,m</sub> (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.5846	31.7395	31.7395	31.9603	31.9603	32.2321	32.1666	32.2959	32.2321	32.0995	32.0995	31.8883	
alpha	3.1056	3.1160	3.1160	3.1307	3.1307	3.1488	3.1444	3.1531	3.1488	3.1400	3.1400	3.1259	
util living area	0.9592	0.9473	0.9165	0.8480	0.7246	0.5223	0.3604	0.3852	0.6556	0.8634	0.9388	0.9633	(86)
MIT	19.3592	19.5231	19.8824	20.3301	20.7100	20.9312	20.9850	20.9815	20.8465	20.3986	19.8246	19.3359	(87)
Th 2	19.9667	19.9712	19.9712	19.9776	19.9776	19.9853	19.9835	19.9871	19.9853	19.9816	19.9816	19.9755	(88)
util rest of house	0.9518	0.9378	0.9007	0.8182	0.6683	0.4315	0.2469	0.2692	0.5729	0.8299	0.9259	0.9566	(89)
MIT 2	18.4965	18.6603	19.0102	19.4400	19.7790	19.9534	19.9801	19.9826	19.8996	19.5156	18.9664	18.4805	(90)
Living area fraction													f <sub>LA</sub> = Living area / (4) =
MIT	18.6900	18.8538	19.2058	19.6396	19.9878	20.1727	20.2055	20.2066	20.1120	19.7136	19.1588	18.6723	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.5400	18.7038	19.0558	19.4896	19.8378	20.0227	20.0555	20.0566	19.9620	19.5636	19.0088	18.5223	(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	0.9385	0.9229	0.8835	0.8016	0.6597	0.4350	0.2552	0.2775	0.5708	0.8134	0.9103	0.9442	(94)	
Useful gains	613.4798	647.2802	666.5287	655.6882	553.3506	365.5460	203.9928	212.1286	407.4220	532.1326	571.2625	590.1275	(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														
Month fracti	1309.1590	1270.1762	1129.8223	923.1231	658.2217	383.9676	206.1584	214.9720	454.5331	763.2725	1055.1433	1294.9838	(97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating	517.5853	418.5861	344.6905	192.5532	78.0241	0.0000	0.0000	0.0000	0.0000	171.9681	348.3942	524.4131	(98)	
Space heating per m2												2596.2146	(98)	
												(98) / (4) =	30.4363	(99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)	
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														90.5000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														2868.7454	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	517.5853	418.5861	344.6905	192.5532	78.0241	0.0000	0.0000	0.0000	0.0000	171.9681	348.3942	524.4131	(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)	571.9175	462.5261	380.8734	212.7659	86.2145	0.0000	0.0000	0.0000	0.0000	190.0200	384.9660	579.4620	(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	142.7444	108.4466	86.6435	42.3307	18.7112	0.0000	0.0000	18.3746	41.9028	86.1724	119.7229	142.4315	(64)		
Efficiency of water heater	89.7885	89.8225	89.8385	89.9061	89.8629	87.3000	87.3000	87.3000	87.3000	89.4060	89.6595	89.7970	(216)		
Fuel for water heating, kWh/month	158.9785	120.7343	96.4435	47.0833	20.8220	0.0000	0.0000	21.0477	47.9986	96.3832	133.5307	158.6150	(219)		
Water heating fuel used												901.6367	(219)		
Annual totals kWh/year															
Space heating fuel - main system														2868.7454	(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)														419.1320	(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														2490.3545	(238)

#### 10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2868.7454	3.6300	104.1355	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	901.6367	3.6300	32.7294	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	419.1320	19.4400	81.4793	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	19.4400	-354.6166	(252)
Total energy cost			-16.9725	(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	2868.7454	0.2160	619.6490	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	901.6367	0.2160	194.7535	(264)
Space and water heating			814.4025	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	419.1320	0.5190	217.5295	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			150.0682	(272)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

#### 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	2868.7454	1.2200	3499.8694 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	901.6367	1.2200	1099.9968 (264)
Space and water heating			4599.8662 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	419.1320	3.0700	1286.7352 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			670.1813 (272)
Primary energy kWh/m2/year			7.8568 (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	West
Overshading	Average or unknown
Thermal mass parameter	129.8 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	3.87 (Calculated rate)

#### Overheating Calculation

Summer ventilation heat loss coefficient	278.74 (P1)
Transmission heat loss coefficient	56.26 (37)
Summer heat loss coefficient	335.01 (P2)

#### Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
West	0.000	1.000	None

#### Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (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
East	4.6810	117.5071	0.7600	0.7200	0.7650	207.2300
West	3.5470	117.5071	0.7600	0.7200	0.7650	157.0273

total: 364.2573

Solar gains	Jun 387	Jul 364	Aug 320	(P3/P4)
Internal gains	448	430	439	
Total summer gains	835	794	759	(P5)
Summer gain/loss ratio	2.49	2.37	2.27	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 129.8)	1.09	1.09	1.09	
Threshold temperature	19.58	21.36	21.16	(P7)
Likelihood of high internal temperature	Not significant		Slight	
Assessment of likelihood of high internal temperature:	Slight			

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	219		<b>Issued on Date</b>	16/05/2022	
<b>Assessment Reference</b>	219 S	<b>Prop Type Ref</b>	3B5P		
<b>Property</b>	Plot 219				
<b>SAP Rating</b>	83 B	<b>DER</b>	18.14	<b>TER</b>	18.80
<b>Environmental</b>	86 B	<b>% DER&lt;TER</b>	3.53		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.28	<b>DFEE</b>	47.21	<b>TFEE</b>	53.55
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	11.84		
<b>Assessor Details</b>	Chris Nicholls, , Tel: ,			<b>Assessor ID</b>	U903-0001
<b>Client</b>					

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.80	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	18.14	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-0.66 (-3.5%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.55	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.21	kWh/m <sup>2</sup> /yr	
	-6.4 (-11.9%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	Pass

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

Secondary heating system

None

### 5 Cylinder insulation

Hot water storage

No cylinder

### 6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

### 8 Mechanical ventilation

Not applicable

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

4.68 m<sup>2</sup>, No overhang

Windows facing West

3.55 m<sup>2</sup>, No overhang

Air change rate

3.87 ach

Blinds/curtains

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

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

### 10 Key features

Party wall U-value

0.00

W/m<sup>2</sup>K

Roof U-value

0.11

W/m<sup>2</sup>K

Roof U-value

0.11

W/m<sup>2</sup>K

Door U-value

1.00

W/m<sup>2</sup>K