

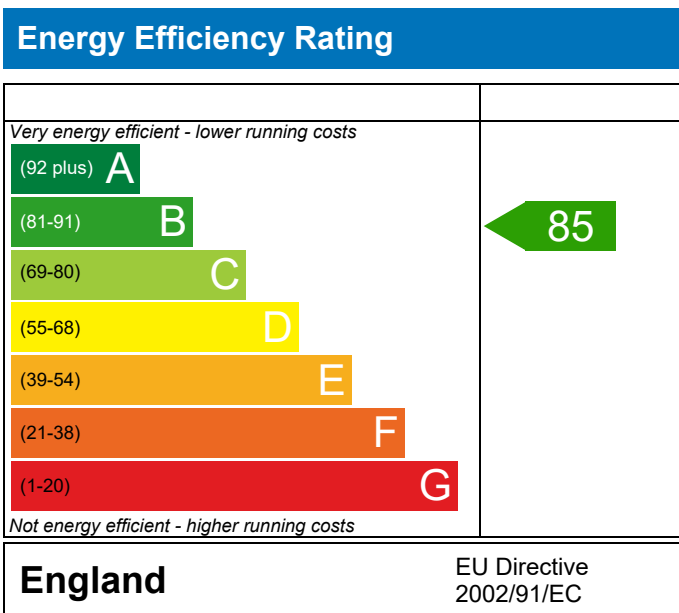
# PREDICTED ENERGY ASSESSMENT

Land North of Grange Road,  
SO31

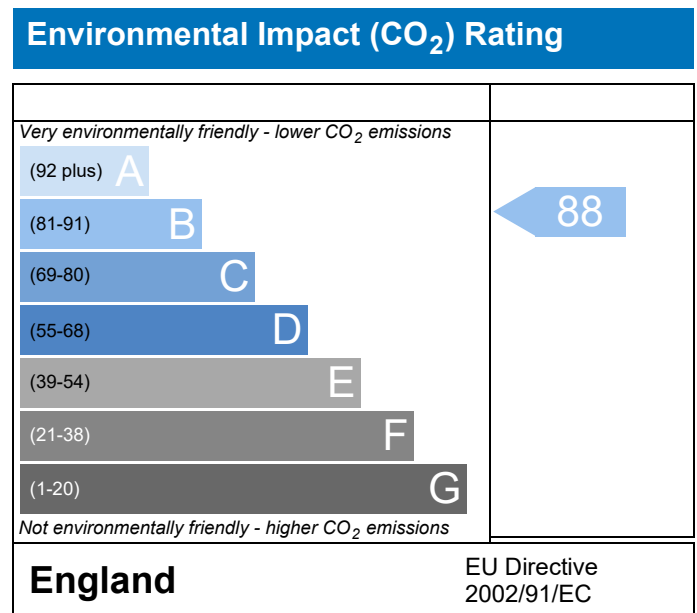
Dwelling type: House, End-Terrace  
Date of assessment: 27/01/2023  
Produced by: Scott Binstead  
Total floor area: 81.82 m<sup>2</sup>

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	055 - PRJ013014			Issued on Date	27/01/2023
Assessment Reference	055	Prop Type Ref	2B		
Property	Land North of Grange Road, SO31				
SAP Rating	85 B	DER	15.14	TER	18.35
Environmental	88 B	% DER<TER	17.48		
CO <sub>2</sub> Emissions (t/year)	1.04	DFEE	44.88	TFEE	50.80
General Requirements Compliance	Pass	% DFEE<TFEE	11.66		
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

End-Terrace House, total floor area 82 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) 18.35 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 15.14 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 44.9 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	OK
Openings	1.36 (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: 5.00 (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: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing East: 2.72 m<sup>2</sup>, No overhang

Windows facing West: 6.36 m<sup>2</sup>, No overhang

Air change rate: 4.67 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 0.08 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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (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	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (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					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5563	(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)					
Total fabric heat loss							(33) + (36) = 53.4756 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.5414	94.2547	93.9737	92.6539	92.4070	91.2574	91.2574	91.0446	91.7002	92.4070	92.9065	93.4288 (39)
Average = Sum(39)m / 12 =												92.6527 (39)
HLP	Jan 1.1555	Feb 1.1520	Mar 1.1485	Apr 1.1324	May 1.1294	Jun 1.1153	Jul 1.1153	Aug 1.1127	Sep 1.1208	Oct 1.1294	Nov 1.1355	Dec 1.1419 (40)
HLP (average)												1.1324 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3323	19.8354	16.1312	12.2124	9.1289	7.7070	8.3277	10.8246	14.5288	18.4476	21.5311	22.9530 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2022	225.5183	219.6817	207.2563	191.5714	176.8299	166.9816	164.6655	170.5021	182.9275	198.6124	213.3539 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	382.0707	379.7241	365.6834	343.2244	320.4852	298.7333	284.7593	291.0255	302.7313	325.4038	351.3184	370.6877 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (76)						
West	6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (80)						
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829 (83)
Total gains	426.5565	466.7477	508.9988	552.2415	576.6434	560.9568	534.4068	505.4690	469.4131	428.6646	406.7869	407.2706 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0200	16.0687	16.1168	16.3464	16.3900	16.5965	16.5965	16.6353	16.5164	16.3900	16.3019	16.2108
alpha	2.0680	2.0712	2.0745	2.0898	2.0927	2.1064	2.1064	2.1090	2.1011	2.0927	2.0868	2.0807
util living area	0.9504	0.9381	0.9146	0.8699	0.7986	0.6917	0.5775	0.6128	0.7717	0.8886	0.9367	0.9546 (86)
MIT	17.8020	18.0532	18.5479	19.2362	19.9006	20.4563	20.7424	20.6971	20.2516	19.4009	18.4974	17.7629 (87)
Th 2	19.9558	19.9586	19.9614	19.9745	19.9769	19.9883	19.9883	19.9904	19.9839	19.9769	19.9719	19.9668 (88)
util rest of house	0.9445	0.9307	0.9037	0.8516	0.7661	0.6325	0.4844	0.5239	0.7234	0.8693	0.9279	0.9492 (89)
MIT 2	15.6852	16.0474	16.7594	17.7464	18.6799	19.4349	19.7848	19.7393	19.1777	17.9944	16.6961	15.6313 (90)
Living area fraction									FLA = Living area / (4) =			0.1678 (91)
MIT	16.0404	16.3840	17.0595	17.9964	18.8848	19.6063	19.9455	19.9000	19.3579	18.2304	16.9983	15.9890 (92)
Temperature adjustment												-0.1500
adjusted MIT	15.8904	16.2340	16.9095	17.8464	18.7348	19.4563	19.7955	19.7500	19.2079	18.0804	16.8483	15.8390 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	387.3654	415.4150	436.2757	441.8960	413.0021	334.0643	247.9782	252.3765	317.6967	351.0471	360.7224	372.5776 (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	1095.7743	1068.2790	978.2187	828.9219	650.0602	443.1713	291.6110	304.9993	468.3931	691.2430	905.6845	1087.4160 (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	527.0563	438.7247	403.2056	278.6587	176.3713	0.0000	0.0000	0.0000	0.0000	253.1057	392.3727	531.8398 (98)
Space heating												3001.3346 (98)
Space heating per m2												(98) / (4) = 36.6822 (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

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													3316.3919 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	527.0563	438.7247	403.2056	278.6587	176.3713	0.0000	0.0000	0.0000	0.0000	253.1057	392.3727	531.8398	(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)	582.3826	484.7786	445.5310	307.9101	194.8854	0.0000	0.0000	0.0000	0.0000	279.6748	433.5610	587.6683	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.9215	89.8971	89.8306	89.6745	89.3775	87.3000	87.3000	87.3000	87.3000	89.5796	89.8146	87.3000	(216)
Fuel for water heating, kWh/month	124.7760	109.2878	114.5234	104.2130	102.8522	94.1970	91.8250	101.0747	100.9497	110.0538	114.8683	121.4339	(219)
Water heating fuel used													1290.0548 (219)
Annual totals kWh/year													
Space heating fuel - main system													3316.3919 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.3960 (232)
Total delivered energy for all uses													5075.8426 (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	3316.3919	0.2160	716.3406 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.0548	0.2160	278.6518 (264)
Space and water heating			994.9925 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Total CO2, kg/year			1238.6090 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1400 (273)

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

DER			15.1400 ZC1
Total Floor Area		TFA	81.8200
Assumed number of occupants		N	2.4965
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1654 ZC2
CO2 emissions from cooking, equation (L16)			2.1867 ZC3
Total CO2 emissions			33.4921 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			33.4921 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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (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	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1300	5.3186		(28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.1800	14.2564		(29a)					
RF - Ins Joist	40.9120		40.9120	0.1300	5.3186		(30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0214		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8094 (36)					
Total fabric heat loss							(33) + (36) = 47.8308 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	88.8965	88.6099	88.3289	87.0090	86.7621	85.6126	85.6126	85.3997	86.0554	86.7621	87.2617	87.7839 (39)
Average = Sum(39)m / 12 =												87.0079 (39)
HLP	Jan 1.0865	Feb 1.0830	Mar 1.0796	Apr 1.0634	May 1.0604	Jun 1.0464	Jul 1.0464	Aug 1.0438	Sep 1.0518	Oct 1.0604	Nov 1.0665	Dec 1.0729 (40)
HLP (average)												1.0634 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	50.9589	45.6136	48.5951	45.1833	44.7837	41.4949	42.8781	44.7837	45.1833	48.5951	48.8718	50.9589	61									
Solar input	203.4687	178.9997	186.2376	165.1834	159.9266	140.8545	134.9493	150.4368	152.0983	173.1942	184.8814	198.6565	62									
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63									
Heat gains from water heating, kWh/month	203.4687	178.9997	186.2376	165.1834	159.9266	140.8545	134.9493	150.4368	152.0983	173.1942	184.8814	198.6565	64									
	63.4492	55.7543	57.9149	51.1958	49.4810	43.4108	41.3332	46.3256	46.8450	53.5780	57.4411	61.8492	65									

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4705	19.9581	16.2310	12.2879	9.1854	7.7547	8.3792	10.8916	14.6187	18.5617	21.6643	23.0950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2022	225.5183	219.6817	207.2563	191.5714	176.8299	166.9816	164.6655	170.5021	182.9275	198.6124	213.3539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	(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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	(71)
Water heating gains (Table 5)	85.2812	82.9677	77.8426	71.1053	66.5067	60.2927	55.5554	62.2656	65.0626	72.0134	79.7794	83.1306	(72)
Total internal gains	394.4012	391.8914	377.2027	354.0969	330.7108	308.3246	294.3635	301.2699	313.6306	336.9499	363.5033	383.0269	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
East	2.7240	19.6403	0.6300	0.7000	0.7700	16.3503
West	6.3550	19.6403	0.6300	0.7000	0.7700	38.1447
Solar gains	54.4951	106.6039	175.5614	256.0459	313.7939	321.2239
Total gains	448.8963	498.4953	552.7641	610.1428	644.5046	629.5484

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	63.9164	64.1232	64.3271	65.3029	65.4888	66.3681	66.3681	66.5335	66.0266	65.4888	65.1139	64.7265	
tau	5.2611	5.2749	5.2885	5.3535	5.3659	5.4245	5.4245	5.4356	5.4018	5.3659	5.3409	5.3151	
alpha	0.9987	0.9975	0.9933	0.9766	0.9208	0.7803	0.6080	0.6638	0.8954	0.9862	0.9974	0.9990	(86)
util living area	19.7966	19.9200	20.1492	20.4671	20.7509	20.9337	20.9862	20.9783	20.8479	20.4804	20.0878	19.7807	(87)
MIT	20.0119	20.0148	20.0176	20.0308	20.0333	20.0449	20.0449	20.0470	20.0404	20.0333	20.0283	20.0230	(88)
util rest of house	0.9983	0.9966	0.9908	0.9671	0.8871	0.6964	0.4860	0.5422	0.8383	0.9789	0.9964	0.9987	(89)
MIT 2	18.3984	18.5808	18.9169	19.3844	19.7747	19.9974	20.0394	20.0373	19.9084	19.4099	18.8362	18.3832	(90)
Living area fraction	18.6331	18.8055	19.1237	19.5661	19.9385	20.1545	20.1983	20.1952	20.0661	19.5895	19.0463	18.6177	(91)
MIT	18.6331	18.8055	19.1237	19.5661	19.9385	20.1545	20.1983	20.1952	20.0661	19.5895	19.0463	18.6177	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6331	18.8055	19.1237	19.5661	19.9385	20.1545	20.1983	20.1952	20.0661	19.5895	19.0463	18.6177	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Useful gains	447.6927	495.9782	545.8642	586.3515	569.1486	445.1257	303.9761	317.1256	435.0523	451.4953	429.1703	426.9517	(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	1274.1595	1232.1683	1115.0333	928.0466	714.7939	475.5349	308.0566	324.1128	513.4127	779.9498	1042.4513	1265.6399	(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	614.8913	494.7198	423.4618	246.0205	108.3601	0.0000	0.0000	0.0000	0.0000	244.3702	441.5623	623.9840	(98)
Space heating												3197.3700	(98)
Space heating per m2												39.0781	(99)

#### 8c. Space cooling requirement

Not applicable

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



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3423.3084 (211)
Space heating requirement	614.8913	494.7198	423.4618	246.0205	108.3601	0.0000	0.0000	0.0000	0.0000	244.3702	441.5623	623.9840	(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)	658.3419	529.6786	453.3852	263.4052	116.0172	0.0000	0.0000	0.0000	0.0000	261.6383	472.7648	668.0771	(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	203.4687	178.9997	186.2376	165.1834	159.9266	140.8545	134.9493	150.4368	152.0983	173.1942	184.8814	198.6565	(64)
Efficiency of water heater (217)m	87.6587	87.4767	87.0553	86.0521	84.0948	80.3000	80.3000	80.3000	80.3000	85.9177	87.1644	87.7352	(217)
Fuel for water heating, kWh/month	232.1147	204.6256	213.9301	191.9573	190.1742	175.4103	168.0564	187.3435	189.4125	201.5814	212.1065	226.4275	(219)
Water heating fuel used													2393.1401 (219)
Annual totals kWh/year													
Space heating fuel - main system													3423.3084 (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)													396.8354 (232)
Total delivered energy for all uses													6288.2838 (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	3423.3084	0.2160	739.4346 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2393.1401	0.2160	516.9183 (264)
Space and water heating			1256.3529 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	396.8354	0.5190	205.9576 (268)
Total CO2, kg/m2/year			1501.2354 (272)
Emissions per m2 for space and water heating			15.3551 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5172 (272b)
Emissions per m2 for pumps and fans			0.4757 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3551 * 1.00) + 2.5172 + 0.4757, rounded to 2 d.p.			18.3500 (273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (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	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (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					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)					
Total fabric heat loss							(33) + (36) = 53.4756 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.5414	94.2547	93.9737	92.6539	92.4070	91.2574	91.2574	91.0446	91.7002	92.4070	92.9065	93.4288 (39)
Average = Sum(39)m / 12 =												92.6527 (39)
HLP	Jan 1.1555	Feb 1.1520	Mar 1.1485	Apr 1.1324	May 1.1294	Jun 1.1153	Jul 1.1153	Aug 1.1127	Sep 1.1208	Oct 1.1294	Nov 1.1355	Dec 1.1419 (40)
HLP (average)												1.1324 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water 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	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.4083	28.3445	29.2490	25.5000	24.4679	21.1139	19.5651	22.4513	22.7194	26.4773	28.9020	31.3857	(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	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	124.8244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3323	19.8354	16.1312	12.2124	9.1289	7.7070	8.3277	10.8246	14.5288	18.4476	21.5311	22.9530	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2022	225.5183	219.6817	207.2563	191.5714	176.8299	166.9816	164.6655	170.5021	182.9275	198.6124	213.3539	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	35.4824	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	(71)
Water heating gains (Table 5)	43.5596	42.1794	39.3132	35.4167	32.8869	29.3249	26.2972	30.1765	31.5548	35.5878	40.1417	42.1851	(72)
Total internal gains	349.5414	347.9804	335.5735	315.3327	294.0346	274.3090	262.0538	266.1139	277.0329	297.4102	320.7325	338.9394	(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	2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (76)							
West	6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (80)							
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829	(83)
Total gains	394.0272	435.0040	478.8889	524.3497	550.1928	536.5326	511.7013	480.5574	443.7147	400.6710	376.2010	375.5223	(84)

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

Utilisation during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0200	16.0687	16.1168	16.3464	16.3900	16.5965	16.5965	16.6353	16.5164	16.3900	16.3019	16.2108	(85)
tau	2.0680	2.0712	2.0745	2.0898	2.0927	2.1064	2.1064	2.1090	2.1011	2.0927	2.0868	2.0807	
alpha	0.9569	0.9452	0.9228	0.8797	0.8109	0.7064	0.5931	0.6307	0.7876	0.8998	0.9447	0.9607	(86)
util living area	17.7247	17.9803	18.4833	19.1837	19.8610	20.4313	20.7281	20.6787	20.2163	19.3448	18.4269	17.6861	(87)
MIT	19.9558	19.9586	19.9614	19.9745	19.9769	19.9883	19.9883	19.9904	19.9839	19.9769	19.9719	19.9668	(88)
Th 2	0.9516	0.9385	0.9128	0.8625	0.7795	0.6481	0.4996	0.5420	0.7410	0.8821	0.9369	0.9560	(89)
util rest of house	16.9439	17.1989	17.6983	18.3948	19.0509	19.5889	19.8398	19.8060	19.4008	18.5628	17.6533	16.9126	(90)
Living area fraction	17.0750	17.3300	17.8300	18.5272	19.1868	19.7303	19.9889	19.9524	19.5376	18.6940	17.7831	17.0424	(92)
MIT	17.0750	17.3300	17.8300	18.5272	19.1868	19.7303	19.9889	19.9524	19.5376	18.6940	17.7831	17.0424	(93)
Temperature adjustment												0.0000	
adjusted MIT	17.0750	17.3300	17.8300	18.5272	19.1868	19.7303	19.9889	19.9524	19.5376	18.6940	17.7831	17.0424	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9313	0.9152	0.8853	0.8316	0.7503	0.6309	0.4997	0.5382	0.7161	0.8529	0.9137	0.9370	(94)
Useful gains	366.9725	398.1110	423.9525	436.0457	412.7927	338.4859	255.6927	298.6318	317.7545	341.7340	343.7242	351.8524	(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	1207.7634	1171.5902	1064.7258	891.9976	691.8367	468.1769	309.2601	323.4309	498.6297	747.9412	992.5329	1199.8535	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	625.5484	519.7780	476.7353	328.2854	207.6087	0.0000	0.0000	0.0000	0.0000	302.2182	467.1422	630.9129	(98)
Space heating												3558.2291	(98)
Space heating per m2												43.4885	(99)

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	857.8199	675.3050	691.9387	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6178	0.6856	0.6601	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	529.9783	463.0035	456.7677	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	721.4178	690.5436	656.0608	0.0000	0.0000	0.0000	0.0000	(103)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	137.8364	169.2899	148.2740	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												455.4004 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												
Space cooling per m2												113.8501 (107)
Energy for space heating												1.3915 (108)
Energy for space cooling												43.4885 (99)
Total												1.3915 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.8800 (109)
												44.9 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (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	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1300	5.3186		(28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.1800	14.2564		(29a)					
RF - Ins Joist	40.9120		40.9120	0.1300	5.3186		(30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0214		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8094 (36)					
Total fabric heat loss							(33) + (36) = 47.8308 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	88.8965	88.6099	88.3289	87.0090	86.7621	85.6126	85.6126	85.3997	86.0554	86.7621	87.2617	87.7839 (39)
Average = Sum(39)m / 12 =												87.0079 (39)
HLP	Jan 1.0865	Feb 1.0830	Mar 1.0796	Apr 1.0634	May 1.0604	Jun 1.0464	Jul 1.0464	Aug 1.0438	Sep 1.0518	Oct 1.0604	Nov 1.0665	Dec 1.0729 (40)
HLP (average)												1.0634 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	21.0882	33.6075	26.1658	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												80.8615 (107)
Space cooling per m2												0.9883 (108)
Energy for space heating												43.1871 (99)
Energy for space cooling												0.9883 (108)
Total												44.1754 (109)
Target Fabric Energy Efficiency (TFEE)												50.8 (109)

-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 4.9000	Feb 4.6000	Mar 4.5000	Apr 4.2000	May 4.2000	Jun 4.1000	Jul 4.1000	Aug 4.0000	Sep 4.0000	Oct 4.3000	Nov 4.3000	Dec 4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4498	0.4223	0.4131	0.3855	0.3855	0.3764	0.3764	0.3672	0.3672	0.3947	0.3947	0.4039 (22b)
Effective ac	0.6012	0.5892	0.5853	0.5743	0.5743	0.5708	0.5708	0.5674	0.5674	0.5779	0.5779	0.5816 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)					
Total fabric heat loss							(33) + (36) = 53.4756 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4981	Feb 39.6892	Mar 39.4309	Apr 38.6901	May 38.6901	Jun 38.4545	Jul 38.4545	Aug 38.2246	Sep 38.2246	Oct 38.9313	Nov 38.9313	Dec 39.1783 (38)
Heat transfer coeff	93.9737	93.1648	92.9065	92.1657	92.1657	91.9301	91.9301	91.7002	91.7002	92.4070	92.4070	92.6539 (39)
Average = Sum(39)m / 12 =												92.4254 (39)
HLP	Jan 1.1485	Feb 1.1387	Mar 1.1355	Apr 1.1264	May 1.1264	Jun 1.1236	Jul 1.1236	Aug 1.1208	Sep 1.1208	Oct 1.1294	Nov 1.1294	Dec 1.1324 (40)
HLP (average)												1.1296 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (64)
RHI water heating demand	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (65)
Heat gains from water heating, kWh/month												1642.5199 (64)
												1643 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
East	2.7240	25.1733	0.5000	0.7200	0.7700	17.1073 (76)						
West	6.3550	25.1733	0.5000	0.7200	0.7700	39.9108 (80)						
Solar gains	57.0182	94.8824	158.5751	232.3325	267.9250	302.6183	278.5361	249.5843	194.1034	122.9158	70.8622	46.0892 (83)
Total gains	624.4806	657.3936	698.6146	737.9148	738.4174	741.9652	699.9895	679.9084	644.5644	608.0475	594.2591	598.2490 (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	16.1168	16.2567	16.3019	16.4329	16.4329	16.4750	16.4750	16.5164	16.5164	16.3900	16.3900	16.3464
alpha	2.0745	2.0838	2.0868	2.0955	2.0955	2.0983	2.0983	2.1011	2.1011	2.0927	2.0927	2.0898
util living area	0.8913	0.8768	0.8403	0.7739	0.6722	0.5149	0.3875	0.3863	0.5916	0.7652	0.8563	0.8965 (86)
MIT	18.5913	18.7716	19.2170	19.8036	20.3604	20.7601	20.9112	20.9147	20.6596	20.0665	19.2953	18.5997 (87)
Th 2	19.9614	19.9694	19.9719	19.9793	19.9793	19.9816	19.9816	19.9839	19.9839	19.9769	19.9769	19.9745 (88)
util rest of house	0.8789	0.8628	0.8212	0.7449	0.6241	0.4377	0.2825	0.2782	0.5185	0.7271	0.8369	0.8845 (89)
MIT 2	16.8137	17.0721	17.7048	18.5285	19.2832	19.7785	19.9333	19.9392	19.6735	18.9040	17.8273	16.8312 (90)
Living area fraction	17.1120	17.3573	17.9586	18.7424	19.4640	19.9432	20.0974	20.1029	19.8390	19.0991	18.0736	17.1279 (92)
Temperature adjustment	16.9620	17.2073	17.8086	18.5924	19.3140	19.7932	19.9474	19.9529	19.6890	18.9491	17.9236	-0.1500
adjusted MIT												16.9779 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8290	0.8119	0.7693	0.6967	0.5880	0.4220	0.2787	0.2747	0.4944	0.6802	0.7852	0.8357 (94)
Ext temp.	517.6872	533.7095	537.4581	514.0869	434.1675	313.0979	195.0900	186.7704	318.6701	413.5789	466.6302	499.9573 (95)
Heat loss rate W	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Month fracti	1058.3357	1034.8048	939.1515	782.7112	572.7134	357.9039	206.6042	197.4249	384.1342	614.4202	843.0876	1035.6790 (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)
RHI space heating demand	402.2424	336.7361	298.8599	193.4095	103.0781	0.0000	0.0000	0.0000	0.0000	149.4259	271.0494	398.5769 (98)
												2153.3782 (98)
												2153 (98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (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	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
Effective ac	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (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					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)					
Total fabric heat loss							(33) + (36) = 53.4756 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.5414	94.2547	93.9737	92.6539	92.4070	91.2574	91.2574	91.0446	91.7002	92.4070	92.9065	93.4288 (39)
Average = Sum(39)m / 12 =												92.6527 (39)
HLP	Jan 1.1555	Feb 1.1520	Mar 1.1485	Apr 1.1324	May 1.1294	Jun 1.1153	Jul 1.1153	Aug 1.1127	Sep 1.1208	Oct 1.1294	Nov 1.1355	Dec 1.1419 (40)
HLP (average)												1.1324 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (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	2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (76)						
West	6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (80)						
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829 (83)
Total gains	611.9483	649.5348	683.3550	714.5993	726.6507	701.5705	671.1009	644.7677	617.1428	588.3925	578.8654	588.7427 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9088	0.8935	0.8647	0.8117	0.7314	0.6142	0.4961	0.5255	0.6859	0.8221	0.8871	0.9146 (86)
MIT	18.2128	18.4421	18.8905	19.5105	20.0962	20.5753	20.8098	20.7779	20.4206	19.6843	18.8616	18.1732 (87)
Th 2	19.9558	19.9586	19.9614	19.9745	19.9769	19.9883	19.9883	19.9904	19.9839	19.9769	19.9719	19.9668 (88)
util rest of house	0.8988	0.8819	0.8491	0.7882	0.6938	0.5525	0.4074	0.4391	0.6310	0.7954	0.8730	0.9053 (89)
MIT 2	16.2687	16.5970	17.2377	18.1192	18.9304	19.5677	19.8435	19.8133	19.3788	18.3773	17.2079	16.2156 (90)
Living area fraction									FLA = Living area / (4) =			0.1678 (91)
MIT	16.5949	16.9066	17.5150	18.3526	19.1260	19.7368	20.0057	19.9752	19.5536	18.5966	17.4854	16.5441 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4449	16.7566	17.3650	18.2026	18.9760	19.5868	19.8557	19.8252	19.4036	18.4466	17.3354	16.3941 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	520.9707	540.5409	544.7842	526.8146	472.3504	368.1862	264.7778	272.9851	366.6811	437.8447	476.3214	505.8667 (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	1148.1981	1117.5414	1021.0285	861.9259	672.3566	455.0790	297.1056	311.8453	486.3423	725.0805	950.9348	1139.2824 (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	466.6572	387.7443	354.3258	241.2801	148.8046	0.0000	0.0000	0.0000	0.0000	213.7035	341.7216	471.2613 (98)
Space heating												2625.4983 (98)
Space heating per m2												(98) / (4) = 32.0887 (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													2901.1031 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.6572	387.7443	354.3258	241.2801	148.8046	0.0000	0.0000	0.0000	0.0000	213.7035	341.7216	471.2613	(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)	515.6433	428.4468	391.5202	266.6079	164.4250	0.0000	0.0000	0.0000	0.0000	236.1364	377.5929	520.7307	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.8615	89.8343	89.7597	89.5832	89.2507	87.3000	87.3000	87.3000	87.3000	89.4648	89.7372	87.3000	(216)
Fuel for water heating, kWh/month	124.8593	109.3642	114.6140	104.3191	102.9983	94.1970	91.8250	101.0747	100.9497	110.1950	114.9673	121.5126	(219)
Water heating fuel used												1290.8761	(219)
Annual totals kWh/year													
Space heating fuel - main system													2901.1031 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.3960 (232)
Total delivered energy for all uses													4661.3752 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2901.1031	3.4800	100.9584 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1290.8761	3.4800	44.9225 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.3960	13.1900	52.0208 (250)
Additional standing charges			120.0000 (251)
Total energy cost			327.7942 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0856 (257)
SAP value		84.8561
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2901.1031	0.2160	626.6383 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.8761	0.2160	278.8292 (264)
Space and water heating			905.4675 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Total kg/year			1149.0840 (272)
CO2 emissions per m2			14.0400 (273)
EI value			87.8586
EI rating			88 (274)
EI band			B

#### Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$ , 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	$3.48 / 0.8888 = 3.915$ , stars = 5
Water heating environmental impact	$0.216 / 0.8888 = 0.2430$ , stars = 5

# 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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3970 (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) =	0.3672 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4498	0.4223	0.4131	0.3855	0.3855	0.3764	0.3764	0.3672	0.3672	0.3947	0.3947	0.4039 (22b)
Effective ac	0.6012	0.5892	0.5853	0.5743	0.5743	0.5708	0.5708	0.5674	0.5674	0.5779	0.5779	0.5816 (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
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			172.1960				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	45.5563	(33)
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)
Stud			70.7018			7.4000	523.1936 (32c)
Internal Floor			40.9120			7.4000	302.7488 (32d)
Internal Ceiling			40.9120			7.4000	302.7488 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							66.6389 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)
Total fabric heat loss							(33) + (36) = 53.4756 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.4981	39.6892	39.4309	38.6901	38.6901	38.4545	38.4545	38.2246	38.2246	38.9313	38.9313	39.1783 (38)
Heat transfer coeff	93.9737	93.1648	92.9065	92.1657	92.1657	91.9301	91.9301	91.7002	91.7002	92.4070	92.4070	92.6539 (39)
Average = Sum(39)m / 12 =												92.4254 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1485	1.1387	1.1355	1.1264	1.1264	1.1236	1.1236	1.1208	1.1208	1.1294	1.1294	1.1324 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

Assumed occupancy	2.4965 (42)											
Average daily hot water use (litres/day)	93.4916 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy content (annual)	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Distribution loss (46)m = 0.15 x (45)m												1470.9864 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	2.7240	25.1733	0.5000	0.7200	0.7700	17.1073 (76)						
West	6.3550	25.1733	0.5000	0.7200	0.7700	39.9108 (80)						
Solar gains	57.0182	94.8824	158.5751	232.3325	267.9250	302.6183	278.5361	249.5843	194.1034	122.9158	70.8622	46.0892 (83)
Total gains	624.4806	657.3936	698.6146	737.9148	738.4174	741.9652	699.9895	679.9084	644.5644	608.0475	594.2591	598.2490 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.8913	0.8768	0.8403	0.7739	0.6722	0.5149	0.3875	0.3863	0.5916	0.7652	0.8563	0.8965 (86)
MIT	18.5913	18.7716	19.2170	19.8036	20.3604	20.7601	20.9112	20.9147	20.6596	20.0665	19.2953	18.5997 (87)
Th 2	19.9614	19.9694	19.9719	19.9793	19.9793	19.9816	19.9816	19.9839	19.9839	19.9769	19.9769	19.9745 (88)
util rest of house	0.8789	0.8628	0.8212	0.7449	0.6241	0.4377	0.2825	0.2782	0.5185	0.7271	0.8369	0.8845 (89)
MIT 2	16.8137	17.0721	17.7048	18.5285	19.2832	19.7785	19.9333	19.9392	19.6735	18.9040	17.8273	16.8312 (90)
Living area fraction									fLA = Living area / (4) =			0.1678 (91)
MIT	17.1120	17.3573	17.9586	18.7424	19.4640	19.9432	20.0974	20.1029	19.8390	19.0991	18.0736	17.1279 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9620	17.2073	17.8086	18.5924	19.3140	19.7932	19.9474	19.9529	19.6890	18.9491	17.9236	16.9779 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	517.6872	533.7095	537.4581	514.0869	434.1675	313.0979	195.0900	186.7704	318.6701	413.5789	466.6302	499.9573 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1058.3357	1034.8048	939.1515	782.7112	572.7134	357.9039	206.6042	197.4249	384.1342	614.4202	843.0876	1035.6790 (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	402.2424	336.7361	298.8599	193.4095	103.0781	0.0000	0.0000	0.0000	0.0000	149.4259	271.0494	398.5769 (98)
Space heating												2153.3782 (98)
Space heating per m2												(98) / (4) = 26.3185 (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													2379.4234 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.2424	336.7361	298.8599	193.4095	103.0781	0.0000	0.0000	0.0000	0.0000	149.4259	271.0494	398.5769	(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)	444.4668	372.0841	330.2319	213.7122	113.8985	0.0000	0.0000	0.0000	0.0000	165.1115	299.5021	440.4165	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.7822	89.7569	89.6584	89.4321	88.9628	87.3000	87.3000	87.3000	87.3000	89.2003	89.5946	87.3000	(216)
Fuel for water heating, kWh/month	124.9695	109.4585	114.7434	104.4955	103.3317	94.1970	91.8250	101.0747	100.9497	110.5217	115.1503	121.6317	(219)
Water heating fuel used													1292.3487 (219)
Annual totals kWh/year													
Space heating fuel - main system													2379.4234 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.3960 (232)
Total delivered energy for all uses													4141.1682 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2379.4234	3.6300	86.3731 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.3487	3.6300	46.9123 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	394.3960	19.4400	76.6706 (250)
Additional standing charges			95.0000 (251)
Total energy cost			319.5359 (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	2379.4234	0.2160	513.9555 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3487	0.2160	279.1473 (264)
Space and water heating			793.1028 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Total kg/year			1036.7193 (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	2379.4234	1.2200	2902.8966 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3487	1.2200	1576.6654 (264)
Space and water heating			4479.5620 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	394.3960	3.0700	1210.7958 (268)
Primary energy kWh/year			5920.6078 (272)
Primary energy kWh/m2/year			72.3614 (273)

#### SAP 2012 EPC IMPROVEMENTS

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

# 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	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 10.5	-£ 378	-1010 kg (97.4%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 17	-131 kg (12.6%)
-----------------------	-------	-------	-----------------

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£378	12.35 kg/m <sup>2</sup>	A 95	A 97
<b>Total Savings</b>	<b>£378</b>	<b>12.35 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, Southern England):

	Current	Potential	Saving
Electricity	£91	£91	£0
Mains gas	£228	£228	£0
Space heating	£196	£196	£0
Water heating	£47	£47	£0
Lighting	£77	£77	£0
Generated (PV)	-£0	-£378	£378
<b>Total cost of fuels</b>	<b>£319</b>	<b>-£59</b>	<b>£378</b>
<b>Total cost of uses</b>	<b>£320</b>	<b>-£58</b>	<b>£378</b>
Delivered energy	51 kWh/m <sup>2</sup>	27 kWh/m <sup>2</sup>	24 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.0 tonnes	0.0 tonnes	1.0 tonnes
CO2 emissions per m <sup>2</sup>	13 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>	12 kg/m <sup>2</sup>
Primary energy	72 kWh/m <sup>2</sup>	-1 kWh/m <sup>2</sup>	73 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	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (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												
Effective ac	0.4682	0.4590	0.4498	0.4039	0.3947	0.3488	0.3488	0.3396	0.3672	0.3947	0.4131	0.4314 (22b)
	0.6096	0.6053	0.6012	0.5816	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5931 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m2)			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)					
Total fabric heat loss							(33) + (36) = 53.4756 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0658	Feb 40.7791	Mar 40.4981	Apr 39.1783	May 38.9313	Jun 37.7818	Jul 37.7818	Aug 37.5689	Sep 38.2246	Oct 38.9313	Nov 39.4309	Dec 39.9532 (38)
Heat transfer coeff	94.5414	94.2547	93.9737	92.6539	92.4070	91.2574	91.2574	91.0446	91.7002	92.4070	92.9065	93.4288 (39)
Average = Sum(39)m / 12 =												92.6527 (39)
HLP	Jan 1.1555	Feb 1.1520	Mar 1.1485	Apr 1.1324	May 1.1294	Jun 1.1153	Jul 1.1153	Aug 1.1127	Sep 1.1208	Oct 1.1294	Nov 1.1355	Dec 1.1419 (40)
HLP (average)												1.1324 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (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	2.7240	19.6403	0.5000	0.7200	0.7700	13.3472 (76)						
West	6.3550	19.6403	0.5000	0.7200	0.7700	31.1386 (80)						
Solar gains	44.4858	87.0236	143.3155	209.0171	256.1583	262.2236	249.6475	214.4435	166.6818	103.2608	55.4685	36.5829 (83)
Total gains	611.9483	649.5348	683.3550	714.5993	726.6507	701.5705	671.1009	644.7677	617.1428	588.3925	578.8654	588.7427 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	16.0200	16.0687	16.1168	16.3464	16.3900	16.5965	16.5965	16.6353	16.5164	16.3900	16.3019	16.2108
tau	2.0680	2.0712	2.0745	2.0898	2.0927	2.1064	2.1064	2.1090	2.1011	2.0927	2.0868	2.0807
util living area	0.9088	0.8935	0.8647	0.8117	0.7314	0.6142	0.4961	0.5255	0.6859	0.8221	0.8871	0.9146 (86)
MIT	18.2128	18.4421	18.8905	19.5105	20.0962	20.5753	20.8098	20.7779	20.4206	19.6843	18.8616	18.1732 (87)
Th 2	19.9558	19.9586	19.9614	19.9745	19.9769	19.9883	19.9883	19.9904	19.9839	19.9769	19.9719	19.9668 (88)
util rest of house	0.8988	0.8819	0.8491	0.7882	0.6938	0.5525	0.4074	0.4391	0.6310	0.7954	0.8730	0.9053 (89)
MIT 2	16.2687	16.5970	17.2377	18.1192	18.9304	19.5677	19.8435	19.8133	19.3788	18.3773	17.2079	16.2156 (90)
Living area fraction	16.5949	16.9066	17.5150	18.3526	19.1260	19.7368	20.0057	19.9752	19.5536	18.5966	17.4854	16.5441 (92)
Temperature adjustment	16.4449	16.7566	17.3650	18.2026	18.9760	19.5868	19.8557	19.8252	19.4036	18.4466	17.3354	16.3941 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8513	0.8322	0.7972	0.7372	0.6500	0.5248	0.3945	0.4234	0.5942	0.7441	0.8229	0.8592 (94)
Ext temp.	520.9707	540.5409	544.7842	526.8146	472.3504	368.1862	264.7778	272.9851	366.6811	437.8447	476.3214	505.8667 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1148.1981	1117.5414	1021.0285	861.9259	672.3566	455.0790	297.1056	311.8453	486.3423	725.0805	950.9348	1139.2824 (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	466.6572	387.7443	354.3258	241.2801	148.8046	0.0000	0.0000	0.0000	0.0000	213.7035	341.7216	471.2613 (98)
Space heating per m2												2625.4983 (98)
												(98) / (4) = 32.0887 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 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													2901.1031 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.6572	387.7443	354.3258	241.2801	148.8046	0.0000	0.0000	0.0000	0.0000	213.7035	341.7216	471.2613	(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)	515.6433	428.4468	391.5202	266.6079	164.4250	0.0000	0.0000	0.0000	0.0000	236.1364	377.5929	520.7307	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.8615	89.8343	89.7597	89.5832	89.2507	87.3000	87.3000	87.3000	87.3000	89.4648	89.7372	87.3000	(216)
Fuel for water heating, kWh/month	124.8593	109.3642	114.6140	104.3191	102.9983	94.1970	91.8250	101.0747	100.9497	110.1950	114.9673	121.5126	(219)
Water heating fuel used												1290.8761	(219)
Annual totals kWh/year													
Space heating fuel - main system													2901.1031 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.3960 (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													2934.1358 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2901.1031	3.4800	100.9584 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1290.8761	3.4800	44.9225 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.3960	13.1900	52.0208 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			99.9713 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3311 (257)
SAP value		95.3814
SAP rating (Section 12)		95 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2901.1031	0.2160	626.6383 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.8761	0.2160	278.8292 (264)
Space and water heating			905.4675 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			252.6468 (272)
CO2 emissions per m2			3.0900 (273)
EI value			97.3305
EI rating			97 (274)
EI band			A

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	40.9100 (1b)	2.3700 (2b)	96.9567 (1b) - (3b)
First floor	40.9100 (1c)	2.6200 (2c)	107.1842 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 204.1409 (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) =	0.1470 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3970 (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) =	0.3672 (21)							
Wind speed	Jan 4.9000	Feb 4.6000	Mar 4.5000	Apr 4.2000	May 4.2000	Jun 4.1000	Jul 4.1000	Aug 4.0000	Sep 4.0000	Oct 4.3000	Nov 4.3000	Dec 4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4498	0.4223	0.4131	0.3855	0.3855	0.3764	0.3764	0.3672	0.3672	0.3947	0.3947	0.4039 (22b)
Effective ac	0.6012	0.5892	0.5853	0.5743	0.5743	0.5708	0.5708	0.5674	0.5674	0.5779	0.5779	0.5816 (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					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.0800	1.3258	12.0379		(27)					
Flr - Ground			40.9120	0.1940	7.9370	75.6000	3092.9472 (28a)					
Wl - Brick (Timber Frame)	90.3710	11.1690	79.2020	0.2500	19.8005	7.4000	586.0948 (29a)					
RF - Ins Joist	40.9120		40.9120	0.0800	3.2730	7.4000	302.7488 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			172.1960				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.5563		(33)					
Party Wall			46.2040	0.0000	0.0000	7.4000	341.9096 (32)					
Stud			70.7018			7.4000	523.1936 (32c)					
Internal Floor			40.9120			7.4000	302.7488 (32d)					
Internal Ceiling			40.9120			7.4000	302.7488 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5452.3916 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							66.6389 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9193 (36)					
Total fabric heat loss							(33) + (36) = 53.4756 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4981	Feb 39.6892	Mar 39.4309	Apr 38.6901	May 38.6901	Jun 38.4545	Jul 38.4545	Aug 38.2246	Sep 38.2246	Oct 38.9313	Nov 38.9313	Dec 39.1783 (38)
Heat transfer coeff	93.9737	93.1648	92.9065	92.1657	92.1657	91.9301	91.9301	91.7002	91.7002	92.4070	92.4070	92.6539 (39)
Average = Sum(39)m / 12 =												92.4254 (39)
HLP	Jan 1.1485	Feb 1.1387	Mar 1.1355	Apr 1.1264	May 1.1264	Jun 1.1236	Jul 1.1236	Aug 1.1208	Sep 1.1208	Oct 1.1294	Nov 1.1294	Dec 1.1324 (40)
HLP (average)												1.1296 (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												2.4965 (42)
Average daily hot water use (litres/day)												93.4916 (43)
Daily hot water use	102.8407	99.1011	95.3614	91.6217	87.8821	84.1424	84.1424	87.8821	91.6217	95.3614	99.1011	102.8407 (44)
Energy conte	152.5098	133.3861	137.6425	120.0000	115.1429	99.3596	92.0712	105.6531	106.9149	124.5990	136.0096	147.6976 (45)
Energy content (annual)												Total = Sum(45)m = 1470.9864 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	22.8765	20.0079	20.6464	18.0000	17.2714	14.9039	13.8107	15.8480	16.0372	18.6899	20.4014	22.1546 (46)
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	14.6744	13.2376	14.6107	14.0881	14.5205	14.0091	14.4493	14.4955	14.0522	14.5734	14.1627	14.6600 (61)
Total heat required for water heating calculated for each month	167.1843	146.6237	152.2532	134.0882	129.6634	113.3687	106.5206	120.1486	120.9671	139.1724	150.1723	162.3576 (62)
WWHRS	-54.9838	-48.3772	-49.3760	-40.6357	-37.7366	-31.1347	-26.3574	-31.9103	-32.8381	-40.5867	-47.0038	-53.1420 eq. (G10)
Total of WWHRS savings												-494.0823
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156 (64)
Heat gains from water heating, kWh/month	54.3781	47.6603	49.4188	43.4220	41.9151	36.5393	34.2260	38.7535	39.0623	45.0725	48.7639	52.7745 (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	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892	149.7892 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8308	49.5885	40.3280	30.5309	22.8222	19.2675	20.8192	27.0616	36.3220	46.1191	53.8278	57.3825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.1376	336.5945	327.8832	309.3378	285.9275	263.9252	249.2263	245.7693	254.4807	273.0261	296.4364	318.4387 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754	52.4754 (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)	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595	-99.8595 (71)
Water heating gains (Table 5)	73.0889	70.9230	66.4231	60.3084	56.3375	50.7491	46.0027	52.0881	54.2531	60.5814	67.7276	70.9334 (72)
Total internal gains	567.4625	562.5112	540.0395	505.5823	470.4924	439.3469	421.4533	430.3241	450.4610	485.1317	523.3969	552.1598 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	2.7240	25.1733	0.5000	0.7200	0.7700	17.1073 (76)						
West	6.3550	25.1733	0.5000	0.7200	0.7700	39.9108 (80)						
Solar gains	57.0182	94.8824	158.5751	232.3325	267.9250	302.6183	278.5361	249.5843	194.1034	122.9158	70.8622	46.0892 (83)
Total gains	624.4806	657.3936	698.6146	737.9148	738.4174	741.9652	699.9895	679.9084	644.5644	608.0475	594.2591	598.2490 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.8913	0.8768	0.8403	0.7739	0.6722	0.5149	0.3875	0.3863	0.5916	0.7652	0.8563	0.8965 (86)
MIT	18.5913	18.7716	19.2170	19.8036	20.3604	20.7601	20.9112	20.9147	20.6596	20.0665	19.2953	18.5997 (87)
Th 2	19.9614	19.9694	19.9719	19.9793	19.9793	19.9816	19.9816	19.9839	19.9839	19.9769	19.9769	19.9745 (88)
util rest of house	0.8789	0.8628	0.8212	0.7449	0.6241	0.4377	0.2825	0.2782	0.5185	0.7271	0.8369	0.8845 (89)
MIT 2	16.8137	17.0721	17.7048	18.5285	19.2832	19.7785	19.9333	19.9392	19.6735	18.9040	17.8273	16.8312 (90)
Living area fraction									fLA = Living area / (4) =			0.1678 (91)
MIT	17.1120	17.3573	17.9586	18.7424	19.4640	19.9432	20.0974	20.1029	19.8390	19.0991	18.0736	17.1279 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9620	17.2073	17.8086	18.5924	19.3140	19.7932	19.9474	19.9529	19.6890	18.9491	17.9236	16.9779 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	517.6872	533.7095	537.4581	514.0869	434.1675	313.0979	195.0900	186.7704	318.6701	413.5789	466.6302	499.9573 (95)
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000 (96)
Heat loss rate W	1058.3357	1034.8048	939.1515	782.7112	572.7134	357.9039	206.6042	197.4249	384.1342	614.4202	843.0876	1035.6790 (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	402.2424	336.7361	298.8599	193.4095	103.0781	0.0000	0.0000	0.0000	0.0000	149.4259	271.0494	398.5769 (98)
Space heating												2153.3782 (98)
Space heating per m2												(98) / (4) = 26.3185 (99)

#### 8c. Space cooling requirement



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 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													2379.4234 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.2424	336.7361	298.8599	193.4095	103.0781	0.0000	0.0000	0.0000	0.0000	149.4259	271.0494	398.5769	(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)	444.4668	372.0841	330.2319	213.7122	113.8985	0.0000	0.0000	0.0000	0.0000	165.1115	299.5021	440.4165	(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	112.2004	98.2466	102.8771	93.4524	91.9268	82.2340	80.1632	88.2382	88.1290	98.5857	103.1685	109.2156	(64)
Efficiency of water heater (217)m	89.7822	89.7569	89.6584	89.4321	88.9628	87.3000	87.3000	87.3000	87.3000	89.2003	89.5946	87.3000	(216)
Fuel for water heating, kWh/month	124.9695	109.4585	114.7434	104.4955	103.3317	94.1970	91.8250	101.0747	100.9497	110.5217	115.1503	121.6317	(219)
Water heating fuel used													1292.3487 (219)
Annual totals kWh/year													
Space heating fuel - main system													2379.4234 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.3960 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1217 * 0.80) =													-1946.4459 (233)
Total delivered energy for all uses													2194.7222 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2379.4234	3.6300	86.3731 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.3487	3.6300	46.9123 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	394.3960	19.4400	76.6706 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	19.4400	-378.3891 (252)
Total energy cost			-58.8532 (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	2379.4234	0.2160	513.9555 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3487	0.2160	279.1473 (264)
Space and water heating			793.1028 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.3960	0.5190	204.6915 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	0.5190	-1010.2054 (269)
Total kg/year			26.5139 (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	2379.4234	1.2200	2902.8966 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.3487	1.2200	1576.6654 (264)
Space and water heating			4479.5620 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	394.3960	3.0700	1210.7958 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	3.0700	-5975.5890 (269)
Primary energy kWh/year			-54.9812 (272)
Primary energy kWh/m2/year			-0.6720 (273)

# 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 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

#### Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	66.6 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.67 (Calculated rate)

#### Overheating Calculation

Summer ventilation heat loss coefficient	314.60 (P1)
Transmission heat loss coefficient	53.48 (37)
Summer heat loss coefficient	368.08 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
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	2.7240	125.2818	0.5000	0.7200	0.7650	84.5866
West	6.3550	125.2818	0.5000	0.7200	0.7650	197.3376

total:						281.9242
		Jun	Jul	Aug		
Solar gains		303	282	248		(P3)
Internal gains		436	418	427		
Total summer gains		740	700	675		(P5)

Summer gain/loss ratio	2.01	1.90	1.83	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 66.6)	1.53	1.53	1.53	
Threshold temperature	18.94	20.74	20.67	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	055 - PRJ013014		<b>Issued on Date</b>	27/01/2023	
<b>Assessment Reference</b>	055	<b>Prop Type Ref</b>	2B		
<b>Property</b>	Land North of Grange Road, SO31				
<b>SAP Rating</b>	85 B	<b>DER</b>	15.14	<b>TER</b>	18.35
<b>Environmental</b>	88 B	<b>% DER&lt;TER</b>	17.48		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.04	<b>DFEE</b>	44.88	<b>TFEE</b>	50.80
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	11.66		
<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)	18.35	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	15.14	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-3.21 (-17.5%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.80	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.88	kWh/m <sup>2</sup> /yr	
	-5.9 (-11.6%)	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	0.25 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.36 (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	5.00 (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
---------------------	---	------

# 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

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

### 8 Mechanical ventilation

Not applicable

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

### 9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

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

Windows facing West

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

Air change rate

4.67 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

5.00 (design value)

Maximum

10.0

Pass

### 10 Key features

Party wall U-value

0.00

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

Roof U-value

0.08

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