

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-025			<b>Issued on Date</b>	12/02/2020
<b>Assessment Reference</b>	025	<b>Prop Type Ref</b>	2FF Semi		
<b>Property</b>	Plot 025, 2 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	84 B	<b>DER</b>	16.56	<b>TER</b>	18.64
<b>Environmental</b>	89 B	<b>% DER&lt;TER</b>	11.17		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.87	<b>DFEE</b>	37.86	<b>TFEE</b>	44.96
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	15.79		
<b>Assessor Details</b>	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			<b>Assessor ID</b>	4907-0015
<b>Client</b>	TW North Thames, Taylor Wimpey				

# 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

Top-floor flat, total floor area 62 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) 18.64 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 16.56 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.0 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)37.9 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.40 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

Air permeability at 50 pascals: 4.00 (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 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

#### 5 Cylinder insulation

Hot water storage No cylinder

#### 6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1900 0.1800

Maximum 0.7 OK

#### 9 Summertime temperature

Overheating risk (East Anglia): Slight OK

Based on:

Overshading:

Average

Windows facing North East:

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

Air change rate:

4.00 ach

Blinds/curtains:

None

#### 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

Door U-value 1.08 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (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				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

  

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.2600	6.5100	23.7500	0.2500	5.9375	52.8000	1254.0000 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.5600		9.5600	0.2000	1.9120	9.0000	86.0400 (30)
Dormer Roof	1.7100		1.7100	0.2000	0.3420	9.0000	15.3900 (30)
Total net area of external elements Aum(A, m2)			107.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7764		(33)
E-WM-248			25.5800	0.0000	0.0000	110.0000	2813.8000 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11187.2260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.2647 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2208 (36)
Total fabric heat loss						(33) + (36) =	31.9972 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Average = Sum(39)m / 12 =	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610 (39)
HLP	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033 (40)
HLP (average)												0.9033 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Energy conte	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy content (annual)	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1300.1221 (45)
Water storage loss:	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (65)
												Total per year (kWh/year) = Sum(64)m = 1464.6982 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962 (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)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	317.8119	315.7154	304.0741	285.5741	267.0454	249.1909	237.6439	243.1995	252.7789	271.4677	292.8008	308.5538 (73)

#### 6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m <sup>2</sup>	Table 6a	W/m <sup>2</sup>	Specific data	factor	W					
				or Table 6b	or Table 6c	Table 6d						
Northeast		3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)					
Northeast		2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (75)					
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609 (83)
Total gains	342.1319	365.2194	393.2645	432.0503	463.9382	459.0994	434.0090	399.7440	361.4587	331.9654	323.4015	328.4146 (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	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318
alpha	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955
util living area	0.9944	0.9914	0.9827	0.9527	0.8689	0.7104	0.5503	0.6133	0.8512	0.9681	0.9905	0.9954 (86)
MIT	19.7721	19.8865	20.1215	20.4505	20.7563	20.9327	20.9839	20.9738	20.8369	20.4610	20.0546	19.7331 (87)
Th 2	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647 (88)
util rest of house	0.9930	0.9894	0.9783	0.9399	0.8336	0.6396	0.4539	0.5152	0.7983	0.9571	0.9879	0.9943 (89)
MIT 2	18.5062	18.6728	19.0140	19.4845	19.8997	20.1094	20.1560	20.1493	20.0094	19.5054	18.9187	18.4494 (90)
Living area fraction												FLA = Living area / (4) = 0.3896 (91)
MIT	18.9994	19.1457	19.4455	19.8609	20.2335	20.4302	20.4786	20.4705	20.3318	19.8777	19.3612	18.9496 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9994	19.1457	19.4455	19.8609	20.2335	20.4302	20.4786	20.4705	20.3318	19.8777	19.3612	18.9496 (93)

#### 8. Space heating requirement

Utilisation	0.9905	0.9861	0.9734	0.9344	0.8368	0.6633	0.4911	0.5525	0.8101	0.9524	0.9844	0.9921 (94)
Useful gains	338.8843	360.1295	382.8008	403.6984	388.2362	304.5256	213.1265	220.8537	292.8189	316.1573	318.3660	325.8090 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	824.0635	798.6286	725.7369	614.4786	478.3959	326.8453	217.4376	228.1972	349.3626	520.1184	687.3765	826.8747 (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	360.9733	294.6714	255.1445	151.7618	67.0788	0.0000	0.0000	0.0000	0.0000	151.7471	265.6875	372.7929 (98)
Space heating												1919.8572 (98)
Space heating per m <sup>2</sup>												(98) / (4) = 30.9355 (99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2053.3232 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	360.9733	294.6714	255.1445	151.7618	67.0788	0.0000	0.0000	0.0000	0.0000	151.7471	265.6875	372.7929	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	386.0677	315.1566	272.8818	162.3120	71.7420	0.0000	0.0000	0.0000	0.0000	162.2963	284.1578	398.7089	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.5417	89.4928	89.3630	89.0613	88.4477	87.3000	87.3000	87.3000	87.3000	89.0318	89.4025	87.3000	(216)
Fuel for water heating, kWh/month	166.2302	145.8950	151.8046	134.2673	130.8283	116.0228	109.1391	122.9226	123.7028	139.3945	149.6341	161.3967	(219)
Water heating fuel used													1651.2381 (219)
Annual totals kWh/year													
Space heating fuel - main system													2053.3232 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420													
mechanical ventilation fans (SFP = 0.2420)													43.0666 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.0666 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													4143.1674 (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	2053.3232	0.2160	443.5178	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1651.2381	0.2160	356.6674	(264)
Space and water heating			800.1852	(265)
Pumps and fans	118.0666	0.5190	61.2765	(267)
Energy for lighting	320.5396	0.5190	166.3601	(268)
Total CO2, kg/year			1027.8218	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5600	(273)

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

DER			16.5600	ZC1
Total Floor Area		TFA	62.0600	
Assumed number of occupants		N	2.0392	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.0069	ZC2
CO2 emissions from cooking, equation (L16)			2.7061	ZC3
Total CO2 emissions			36.2730	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			36.2730	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	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (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				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1371 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3871 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3291 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4196	0.4113	0.4031	0.3620	0.3537	0.3126	0.3126	0.3044	0.3291	0.3537	0.3702	0.3867 (22b)
Effective ac	0.5880	0.5846	0.5812	0.5655	0.5626	0.5489	0.5489	0.5463	0.5541	0.5626	0.5685	0.5747 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			6.5100	1.3258	8.6307		(27)					
External Wall	30.2600	6.5100	23.7500	0.1800	4.2750		(29a)					
External Wall to Corridor	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)					
Plane ceiling	52.0400		52.0400	0.1300	6.7652		(30)					
Sloping ceiling	9.5600		9.5600	0.1300	1.2428		(30)					
Dormer Roof	1.7100		1.7100	0.1300	0.2223		(30)					
Total net area of external elements Aum(A, m2)			107.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.3026	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2500 (36)					
Total fabric heat loss						(33) + (36) =	31.5526 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.2997	28.1352	27.9740	27.2167	27.0750	26.4154	26.4154	Aug 26.2933	Sep 26.6695	Oct 27.0750	Nov 27.3616	Dec 27.6613 (38)
Heat transfer coeff	59.8523	59.6878	59.5266	58.7693	58.6276	57.9680	57.9680	57.8459	58.2221	58.6276	58.9142	59.2139 (39)
Average = Sum(39)m / 12 =												58.7686 (39)
HLP	0.9644	0.9618	0.9592	0.9470	0.9447	0.9341	0.9341	0.9321	0.9382	0.9447	0.9493	0.9541 (40)
HLP (average)												0.9470 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	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	46.3192	40.3153	42.9505	39.9350	39.5818	36.6750	37.8975	39.5818	39.9350	42.9505	43.1950	46.3192	(61)											
Total heat required for water heating calculated for each month	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608	(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	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608	(64)											
Heat gains from water heating, kWh/month	56.3991	49.2781	51.1877	45.2491	43.7334	38.3683	36.5321	40.9446	41.4037	47.3545	50.7690	54.9849	(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	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	(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)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	75.8052	73.3305	68.8007	62.8460	58.7815	53.2894	49.1023	55.0330	57.5051	63.6486	70.5125	73.9044	(72)
Total internal gains	328.6549	325.9990	313.8012	294.7463	275.6595	257.2483	245.7070	251.8189	261.9590	281.2026	303.0888	319.3998	(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								
Northeast	6.5100	11.2829	0.6300	0.7000	0.7700	22.4479	(75)						
Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321	(83)
Total gains	351.1027	371.6923	396.1260	429.9473	457.3961	450.9987	426.9565	396.3131	362.2730	337.0434	331.3340	337.7319	(84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)													21.0000	(85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	72.0060	72.2044	72.4000	73.3329	73.5101	74.3466	74.3466	74.5035	74.0221	73.5101	73.1525	72.7823			
alpha	5.8004	5.8136	5.8267	5.8889	5.9007	5.9564	5.9564	5.9669	5.9348	5.9007	5.8768	5.8522			
util living area	0.9985	0.9975	0.9942	0.9789	0.9187	0.7612	0.5859	0.6496	0.8961	0.9862	0.9971	0.9988	(86)		
MIT	19.9836	20.0751	20.2642	20.5439	20.8034	20.9564	20.9923	20.9864	20.8786	20.5640	20.2326	19.9682	(87)		
Th 2	20.1131	20.1153	20.1175	20.1278	20.1297	20.1386	20.1386	20.1403	20.1352	20.1297	20.1258	20.1217	(88)		
util rest of house	0.9980	0.9967	0.9921	0.9705	0.8860	0.6820	0.4773	0.5391	0.8424	0.9793	0.9959	0.9984	(89)		
MIT 2	18.7457	18.8812	19.1585	19.5694	19.9249	20.1075	20.1355	20.1341	20.0287	19.6032	19.1195	18.7298	(90)		
Living area fraction													fLA = Living area / (4) =	0.3896	(91)
MIT	19.2280	19.3464	19.5893	19.9491	20.2672	20.4383	20.4693	20.4662	20.3598	19.9776	19.5532	19.2123	(92)		
Temperature adjustment													0.0000		
adjusted MIT	19.2280	19.3464	19.5893	19.9491	20.2672	20.4383	20.4693	20.4662	20.3598	19.9776	19.5532	19.2123	(93)		

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)		
Useful gains	350.1555	370.1001	392.3074	416.3379	407.9518	320.7622	221.9686	230.8436	310.9620	329.5183	329.6267	337.0042	(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	893.4766	862.2734	779.1621	649.3484	502.2720	338.4324	224.2966	235.2101	364.4611	549.7835	733.6692	888.9382	(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	404.2309	330.7405	287.8199	167.7676	70.1742	0.0000	0.0000	0.0000	0.0000	163.8773	290.9106	410.6389	(98)		
Space heating													2126.1600	(98)	
Space heating per m2													(98) / (4) =	34.2597	(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													2276.4025 (211)
Space heating requirement	404.2309	330.7405	287.8199	167.7676	70.1742	0.0000	0.0000	0.0000	0.0000	163.8773	290.9106	410.6389	(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)	432.7954	354.1119	308.1584	179.6227	75.1330	0.0000	0.0000	0.0000	0.0000	175.4575	311.4675	439.6562	(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	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608	(64)
Efficiency of water heater (217)m	87.0136	86.8648	86.4442	85.4018	83.3909	80.3000	80.3000	80.3000	80.3000	85.2230	86.4874	87.1019	(217)
Fuel for water heating, kWh/month	208.1444	182.1310	190.4176	170.9522	169.5030	155.0353	148.5356	165.5824	167.4111	179.6188	188.9365	203.0503	(219)
Water heating fuel used													2129.3182 (219)
Annual totals kWh/year													
Space heating fuel - main system													2276.4025 (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)													320.5396 (232)
Total delivered energy for all uses													4801.2603 (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	2276.4025	0.2160	491.7029 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2129.3182	0.2160	459.9327 (264)
Space and water heating			951.6357 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total CO2, kg/m2/year			1156.9207 (272)
Emissions per m2 for space and water heating			15.3341 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6806 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3341 * 1.00) + 2.6806 + 0.6272, rounded to 2 d.p.			18.6400 (273)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3500 (2b)	= 145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 145.8410 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1371 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3654	0.3582	0.3510	0.3152	0.3081	0.2722	0.2722	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5667	0.5642	0.5616	0.5497	0.5474	0.5371	0.5371	0.5351	0.5411	0.5474	0.5520	0.5567 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.2600	6.5100	23.7500	0.2500	5.9375	52.8000	1254.0000 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.5600		9.5600	0.2000	1.9120	9.0000	86.0400 (30)
Dormer Roof	1.7100		1.7100	0.2000	0.3420	9.0000	15.3900 (30)
Total net area of external elements Aum(A, m2)			107.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7764		(33)
E-WM-248				0.0000	0.0000	110.0000	2813.8000 (32)
E-FC-4						70.0000	4344.2000 (32d)
Metal						14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11187.2260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.2647 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2208 (36)
Total fabric heat loss							(33) + (36) = 31.9972 (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	27.2762	27.1514	27.0292	26.4549	26.3474	25.8472	25.8472	25.7546	26.0399	26.3474	26.5648	26.7920 (38)
Heat transfer coeff	59.2734	59.1486	59.0264	58.4521	58.3446	57.8444	57.8444	57.7518	58.0371	58.3446	58.5620	58.7892 (39)
Average = Sum(39)m / 12 =												58.4515 (39)
HLP	0.9551	0.9531	0.9511	0.9419	0.9401	0.9321	0.9321	0.9306	0.9352	0.9401	0.9436	0.9473 (40)
HLP (average)												0.9419 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	587.5919	558.6177	517.8177	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	89.8558	125.5545	97.3626	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												312.7729 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	22.4640	31.3886	24.3407	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												78.1932 (107)
Space cooling per m2												1.2600 (108)
Energy for space heating												36.5989 (99)
Energy for space cooling												1.2600 (108)
Total												37.8588 (109)
Dwelling Fabric Energy Efficiency (DFEE)												37.9 (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	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1371 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3871 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3291 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4196	0.4113	0.4031	0.3620	0.3537	0.3126	0.3126	0.3044	0.3291	0.3537	0.3702	0.3867 (22b)
	0.5880	0.5846	0.5812	0.5655	0.5626	0.5489	0.5489	0.5463	0.5541	0.5626	0.5685	0.5747 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			6.5100	1.3258	8.6307		(27)					
External Wall	30.2600	6.5100	23.7500	0.1800	4.2750		(29a)					
External Wall to Corridor	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)					
Plane ceiling	52.0400		52.0400	0.1300	6.7652		(30)					
Sloping ceiling	9.5600		9.5600	0.1300	1.2428		(30)					
Dormer Roof	1.7100		1.7100	0.1300	0.2223		(30)					
Total net area of external elements Aum(A, m2)			107.0600				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.3026	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2500 (36)					
Total fabric heat loss							(33) + (36) = 31.5526 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.2997	28.1352	27.9740	27.2167	27.0750	26.4154	26.4154	26.2933	26.6695	27.0750	27.3616	27.6613 (38)
Average = Sum(39)m / 12 =	59.8523	59.6878	59.5266	58.7693	58.6276	57.9680	57.9680	57.8459	58.2221	58.6276	58.9142	59.2139 (39)
	58.7686 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9644	0.9618	0.9592	0.9470	0.9447	0.9341	0.9341	0.9321	0.9382	0.9447	0.9493	0.9541 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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	16.6539	26.0100	19.4635	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												62.1274 (107)
Space cooling per m2												1.0011 (108)
Energy for space heating												38.0931 (99)
Energy for space cooling												1.0011 (108)
Total												39.0942 (109)
Target Fabric Energy Efficiency (TFEE)												45.0 (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	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		145.8410 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (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				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				2	2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.2600	6.5100	23.7500	0.2500	5.9375	52.8000	1254.0000 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.5600		9.5600	0.2000	1.9120	9.0000	86.0400 (30)
Dormer Roof	1.7100		1.7100	0.2000	0.3420	9.0000	15.3900 (30)
Total net area of external elements Aum(A, m2)			107.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7764		(33)
E-WM-248			25.5800	0.0000	0.0000	110.0000	2813.8000 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11187.2260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.2647 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2208 (36)
Total fabric heat loss						(33) + (36) =	31.9972 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Heat transfer coeff	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610 (39)
Average = Sum(39)m / 12 =												56.0610 (39)
HLP	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033 (40)
HLP (average)												0.9033 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy content (annual)	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1300.1221 (45)
Water storage loss:	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
RHI water heating demand	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (65)
Heat gains from water heating, kWh/month												1465 (64)
												1465 (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	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (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)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Northeast	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (75)						
Solar gains	27.9058	53.1289	94.2596	162.3155	209.7719	232.5890	215.6355	173.8280	121.6967	67.9281	36.0152	22.5400 (83)
Total gains	497.1402	518.1331	540.8128	580.7075	599.7115	597.1466	565.5321	531.4139	495.6718	470.2531	469.5971	479.4022 (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)	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318 (85)
tau	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955
alpha	0.9730	0.9649	0.9385	0.8646	0.7186	0.5132	0.3357	0.3568	0.6389	0.8751	0.9545	0.9764 (86)
util living area	20.1140	20.2051	20.4287	20.7062	20.9062	20.9846	20.9984	20.9980	20.9595	20.7390	20.3873	20.0818 (87)
MIT	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647 (88)
util rest of house	0.9673	0.9575	0.9252	0.8362	0.6666	0.4416	0.2539	0.2701	0.5637	0.8420	0.9434	0.9713 (89)
MIT 2	18.9997	19.1302	19.4475	19.8259	20.0743	20.1544	20.1641	20.1640	20.1341	19.8768	19.3929	18.9538 (90)
Living area fraction	19.4338	19.5490	19.8298	20.1689	20.3984	20.4779	20.4892	20.4889	20.4557	20.2128	19.7804	19.3933 (91)
Temperature adjustment	19.4338	19.5490	19.8298	20.1689	20.3984	20.4779	20.4892	20.4889	20.4557	20.2128	19.7804	19.3933 (92)
adjusted MIT												0.0000 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9611	0.9509	0.9190	0.8364	0.6818	0.4689	0.2858	0.3040	0.5909	0.8441	0.9373	0.9655 (94)
Ext temp.	477.8224	492.6810	497.0062	485.6835	408.8843	280.0050	161.6450	161.5298	292.8864	396.9571	440.1343	462.8655 (95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Month fracti	825.9935	804.4195	719.2532	598.1062	442.7931	284.6694	161.9712	161.9554	305.8522	494.0518	677.2362	823.7189 (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	259.0393	209.4882	165.3518	80.9443	25.2281	0.0000	0.0000	0.0000	0.0000	72.2385	170.7134	268.4749 (98)
RHI space heating demand												1251.4785 (98)
												1251 (98)



**FULL SAP CALCULATION PRINTOUT**  
**Calculation Type: New Build (As Designed)**



**CALCULATION OF HEAT DEMAND** 09 Jan 2014

---

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3500 (2b)	= 145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 145.8410 (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				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.2600	6.5100	23.7500	0.2500	5.9375	52.8000	1254.0000 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.5600		9.5600	0.2000	1.9120	9.0000	86.0400 (30)
Dormer Roof	1.7100		1.7100	0.2000	0.3420	9.0000	15.3900 (30)
Total net area of external elements Aum(A, m2)			107.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7764		(33)
E-WM-248			25.5800	0.0000	0.0000	110.0000	2813.8000 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11187.2260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.2647 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2208 (36)
Total fabric heat loss						(33) + (36) =	31.9972 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Heat transfer coeff	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610 (39)
Average = Sum(39)m / 12 =												56.0610 (39)
HLP	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033 (40)
HLP (average)												0.9033 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy content (annual)	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1300.1221 (45)
Water storage loss:	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (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)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622 (73)

#### 6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m <sup>2</sup>	Table 6a	W/m <sup>2</sup>	Specific data	factor	W					
			or Table 6b	or Table 6b	or Table 6c	Table 6d						
Northeast		3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)					
Northeast		2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (75)					
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609 (83)
Total gains	493.5544	514.5081	535.7435	564.8682	586.8323	574.4661	546.2617	514.1305	482.6549	462.8227	464.1826	476.7231 (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	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318
alpha	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955
util living area	0.9760	0.9680	0.9469	0.8906	0.7724	0.5970	0.4456	0.4916	0.7229	0.9047	0.9625	0.9794 (86)
MIT	20.0636	20.1666	20.3705	20.6389	20.8597	20.9673	20.9933	20.9894	20.9219	20.6615	20.3151	20.0216 (87)
Th 2	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647 (88)
util rest of house	0.9710	0.9613	0.9355	0.8670	0.7273	0.5285	0.3638	0.4068	0.6579	0.8792	0.9535	0.9750 (89)
MIT 2	18.9270	19.0749	19.3655	19.7370	20.0206	20.1394	20.1613	20.1589	20.0969	19.7745	19.2902	18.8667 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.3699	19.5002	19.7570	20.0884	20.3476	20.4620	20.4854	20.4825	20.4184	20.1201	19.6895	19.3166 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3699	19.5002	19.7570	20.0884	20.3476	20.4620	20.4854	20.4825	20.4184	20.1201	19.6895	19.3166 (93)

#### 8. Space heating requirement

Utilisation	0.9650	0.9548	0.9290	0.8646	0.7378	0.5535	0.3955	0.4396	0.6787	0.8776	0.9473	0.9695 (94)
Useful gains	476.2977	491.2532	497.6829	488.4106	432.9456	317.9729	216.0643	225.9992	327.5944	406.1850	439.7191	462.1764 (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	844.8313	818.5033	743.2021	627.2324	484.7907	328.6289	217.8205	228.8680	354.2135	533.7052	705.7799	847.4533 (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	274.1890	219.9120	182.6663	99.9517	38.5727	0.0000	0.0000	0.0000	0.0000	94.8750	191.5638	286.6460 (98)
Space heating												1388.3766 (98)
Space heating per m <sup>2</sup>										(98) / (4) =		22.3715 (99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1484.8948 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	274.1890	219.9120	182.6663	99.9517	38.5727	0.0000	0.0000	0.0000	0.0000	94.8750	191.5638	286.6460	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	293.2503	235.2001	195.3650	106.9002	41.2542	0.0000	0.0000	0.0000	0.0000	101.4706	204.8811	306.5733	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.3477	89.2808	89.1080	88.7284	88.0786	87.3000	87.3000	87.3000	87.3000	88.6582	89.1562	87.3000	(216)
Fuel for water heating, kWh/month	166.5913	146.2414	152.2389	134.7710	131.3765	116.0228	109.1391	122.9226	123.7028	139.9819	150.0476	161.7236	(219)
Water heating fuel used													1654.7594 (219)
Annual totals kWh/year													
Space heating fuel - main system													1484.8948 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420													
mechanical ventilation fans (SFP = 0.2420)													43.0666 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.0666 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3578.2603 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1484.8948	3.4800	51.6743 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1654.7594	3.4800	57.5856 (247)
Mechanical ventilation fans	43.0666	13.1900	5.6805 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	320.5396	13.1900	42.2792 (250)
Additional standing charges			120.0000 (251)
Total energy cost			287.1121 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1264 (257)
SAP value		84.2874
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1484.8948	0.2160	320.7373 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.7594	0.2160	357.4280 (264)
Space and water heating			678.1653 (265)
Pumps and fans	118.0666	0.5190	61.2765 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			905.8019 (272)
CO2 emissions per m2			14.6000 (273)
EI value			88.6627
EI rating			89 (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	$3.48 / 0.8841 = 3.936$ , stars = 4
Water heating environmental impact	$0.216 / 0.8841 = 0.2443$ , stars = 4

**FULL SAP CALCULATION PRINTOUT**  
**Calculation Type: New Build (As Designed)**



CALCULATION OF ENERGY RATINGS 09 Jan 2014

---

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3500 (2b)	= 145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 145.8410 (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				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.2600	6.5100	23.7500	0.2500	5.9375	52.8000	1254.0000 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.5600		9.5600	0.2000	1.9120	9.0000	86.0400 (30)
Dormer Roof	1.7100		1.7100	0.2000	0.3420	9.0000	15.3900 (30)
Total net area of external elements Aum(A, m2)			107.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7764		(33)
E-WM-248			25.5800	0.0000	0.0000	110.0000	2813.8000 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11187.2260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.2647 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2208 (36)
Total fabric heat loss						(33) + (36) =	31.9972 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Heat transfer coeff	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610	56.0610 (39)
Average = Sum(39)m / 12 =												56.0610 (39)
HLP	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033	0.9033 (40)
HLP (average)												0.9033 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Energy conte	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy content (annual)	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1300.1221 (45)
Water storage loss:	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (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)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622 (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						
Northeast		3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)					
Northeast		2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (75)					
Solar gains	27.9058	53.1289	94.2596	162.3155	209.7719	232.5890	215.6355	173.8280	121.6967	67.9281	36.0152	22.5400 (83)
Total gains	497.1402	518.1331	540.8128	580.7075	599.7115	597.1466	565.5321	531.4139	495.6718	470.2531	469.5971	479.4022 (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	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318	55.4318 (86)
alpha	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955	4.6955 (87)
util living area	0.9730	0.9649	0.9385	0.8646	0.7186	0.5132	0.3357	0.3568	0.6389	0.8751	0.9545	0.9764 (88)
MIT	20.1140	20.2051	20.4287	20.7062	20.9062	20.9846	20.9984	20.9980	20.9595	20.7390	20.3873	20.0818 (89)
Th 2	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647	20.1647 (90)
util rest of house	0.9673	0.9575	0.9252	0.8362	0.6666	0.4416	0.2539	0.2701	0.5637	0.8420	0.9434	0.9713 (91)
MIT 2	18.9997	19.1302	19.4475	19.8259	20.0743	20.1544	20.1641	20.1640	20.1341	19.8768	19.3929	18.9538 (92)
Living area fraction									fLA = Living area / (4) =			0.3896 (93)
MIT	19.4338	19.5490	19.8298	20.1689	20.3984	20.4779	20.4892	20.4889	20.4557	20.2128	19.7804	19.3933 (94)
Temperature adjustment												0.0000 (95)
adjusted MIT	19.4338	19.5490	19.8298	20.1689	20.3984	20.4779	20.4892	20.4889	20.4557	20.2128	19.7804	19.3933 (96)

#### 8. Space heating requirement

Utilisation	0.9611	0.9509	0.9190	0.8364	0.6818	0.4689	0.2858	0.3040	0.5909	0.8441	0.9373	0.9655 (94)
Useful gains	477.8224	492.6810	497.0062	485.6835	408.8843	280.0050	161.6450	161.5298	292.8864	396.9571	440.1343	462.8655 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	825.9935	804.4195	719.2532	598.1062	442.7931	284.6694	161.9712	161.9554	305.8522	494.0518	677.2362	823.7189 (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	259.0393	209.4882	165.3518	80.9443	25.2281	0.0000	0.0000	0.0000	0.0000	72.2385	170.7134	268.4749 (98)
Space heating per m <sup>2</sup>												1251.4785 (98)
												(98) / (4) = 20.1656 (99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1338.4797 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.0393	209.4882	165.3518	80.9443	25.2281	0.0000	0.0000	0.0000	0.0000	72.2385	170.7134	268.4749	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	277.0474	224.0516	176.8468	86.5715	26.9820	0.0000	0.0000	0.0000	0.0000	77.2604	182.5812	287.1389	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.3054	89.2440	89.0293	88.5641	87.8561	87.3000	87.3000	87.3000	87.3000	88.4507	89.0657	87.3000	(216)
Fuel for water heating, kWh/month	166.6701	146.3018	152.3736	135.0211	131.7093	116.0228	109.1391	122.9226	123.7028	140.3103	150.2001	161.8100	(219)
Water heating fuel used													1656.1835 (219)
Annual totals kWh/year													
Space heating fuel - main system													1338.4797 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.0666 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.0666 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3433.2694 (238)

#### 10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1338.4797	3.9200	52.4684 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1656.1835	3.9200	64.9224 (247)
Mechanical ventilation fans	43.0666	16.9600	7.3041 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	320.5396	16.9600	54.3635 (250)
Additional standing charges			88.0000 (251)
Total energy cost			279.7784 (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	1338.4797	0.2160	289.1116 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.1835	0.2160	357.7356 (264)
Space and water heating			646.8473 (265)
Pumps and fans	118.0666	0.5190	61.2765 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			874.4839 (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	1338.4797	1.2200	1632.9452 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.1835	1.2200	2020.5439 (264)
Space and water heating			3653.4891 (265)
Pumps and fans	118.0666	3.0700	362.4644 (267)
Energy for lighting	320.5396	3.0700	984.0566 (268)
Primary energy kWh/year			5000.0100 (272)
Primary energy kWh/m2/year			80.5674 (273)

#### SAP 2012 EPC IMPROVEMENTS



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 84  
 Current environmental impact rating: B 89

(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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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: (none)      SAP change      Cost change      CO2 change

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)	Total Savings £0	0.00 kg/m <sup>2</sup>	

Potential energy efficiency rating: B 84  
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 2019)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£74	£74	£0
Mains gas	£205	£205	£0
Space heating	£160	£160	£0
Water heating	£65	£65	£0
Lighting	£54	£54	£0
Total cost of fuels	£279	£279	£0
Total cost of uses	£279	£279	£0
Delivered energy	55 kWh/m <sup>2</sup>	55 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	14 kg/m <sup>2</sup>	14 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	81 kWh/m <sup>2</sup>	81 kWh/m <sup>2</sup>	0 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  
-----

No improvements selected / applicable

-----

# 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

No improvements selected / applicable

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

#### Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	East Anglia
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	180.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

#### Overheating Calculation

Summer ventilation heat loss coefficient	192.51 (P1)
Transmission heat loss coefficient	32.00 (37)
Summer heat loss coefficient	224.51 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
North East	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644
total:						252.0415

	Jun	Jul	Aug
Solar gains	272	252	203 (P4)
Internal gains	362	347	355
Total summer gains	633	599	558 (P5)
Summer gain/loss ratio	2.82	2.67	2.48 (P6)
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 180.3)	0.74	0.74	0.74
Threshold temperature	18.96	21.01	20.82 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight
Assessment of likelihood of high internal temperature:	Slight		