

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-028			<b>Issued on Date</b>	12/02/2020
<b>Assessment Reference</b>	028	<b>Prop Type Ref</b>	2FF Semi		
<b>Property</b>	Plot 028, 2 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	85 B	<b>DER</b>	15.02	<b>TER</b>	17.19
<b>Environmental</b>	90 B	<b>% DER&lt;TER</b>	12.64		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.81	<b>DFEE</b>	31.92	<b>TFEE</b>	38.45
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	17.00		
<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				

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### 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) 17.19 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 15.02 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)38.5 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)31.9 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (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	1.33 (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 South West:

7.86 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

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

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

#### 1. Overall dwelling dimensions

	Area (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)							
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	0.2168	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:												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)			3.4500	1.3258	4.5739		(27)					
French Door (Uw = 1.40)			4.4100	1.3258	5.8466		(27)					
External Wall	24.6500	7.8600	16.7900	0.2500	4.1975	52.8000	886.5120 (29a)					
External Wall to Stairwell	12.6400	2.1200	10.5200	0.2000	2.1040	52.8000	555.4560 (29a)					
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)					
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)					
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)					
Total net area of external elements Aum(A, m2)			100.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.4168		(33)					
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (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) =	9807.4620 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.0319 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3727 (36)					
Total fabric heat loss						(33) + (36) =	31.7895 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.0638	Feb 24.0638	Mar 24.0638	Apr 24.0638	May 24.0638	Jun 24.0638	Jul 24.0638	Aug 24.0638	Sep 24.0638	Oct 24.0638	Nov 24.0638	Dec 24.0638 (38)
Heat transfer coeff	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532 (39)
Average = Sum(39)m / 12 =												55.8532 (39)
HLP	Jan 0.9000	Feb 0.9000	Mar 0.9000	Apr 0.9000	May 0.9000	Jun 0.9000	Jul 0.9000	Aug 0.9000	Sep 0.9000	Oct 0.9000	Nov 0.9000	Dec 0.9000 (40)
HLP (average)												0.9000 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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### 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)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
												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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.4152	15.4680	12.5794	9.5234	7.1189	6.0101	6.4941	8.4413	11.3298	14.3858	16.7904	17.8992 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	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)
	317.0769	315.0625	303.5432	285.1721	266.7450	248.9372	237.3698	242.8432	252.3007	270.8605	292.0921	307.7982 (73)

#### 6. Solar gains

[Jan]			Area	Solar flux	g	Specific data	FF	Access	Gains			
			m2	Table 6a	W/m2	or Table 6b	Specific data	factor	W			
							or Table 6c	Table 6d				
Southwest			3.4500	36.7938	0.4300		0.0000	0.7700	42.0294 (79)			
Southwest			4.4100	36.7938	0.4300		0.0000	0.7700	53.7246 (79)			
Solar gains	95.7540	163.1044	223.1666	276.5142	309.7190	307.4792	296.4428	271.6706	241.6422	180.2651	114.6912	81.9454 (83)
Total gains	412.8308	478.1670	526.7098	561.6863	576.4639	556.4164	533.8126	514.5138	493.9429	451.1256	406.7832	389.7437 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760
util living area	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517
MIT	0.9823	0.9669	0.9373	0.8762	0.7652	0.6036	0.4510	0.4860	0.6983	0.8962	0.9684	0.9859 (86)
Th 2	19.7978	20.0037	20.2790	20.5812	20.8214	20.9508	20.9886	20.9843	20.9077	20.5974	20.1280	19.7365 (87)
util rest of house	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675 (88)
MIT 2	0.9789	0.9606	0.9254	0.8526	0.7222	0.5371	0.3697	0.4035	0.6357	0.8713	0.9613	0.9831 (89)
Living area fraction	18.5572	18.8535	19.2458	19.6651	19.9784	20.1270	20.1612	20.1581	20.0844	19.6955	19.0360	18.4686 (90)
MIT	19.0406	19.3017	19.6484	20.0220	20.3068	20.4480	20.4836	20.4800	20.4052	20.0469	19.4614	18.9626 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0406	19.3017	19.6484	20.0220	20.3068	20.4480	20.4836	20.4800	20.4052	20.0469	19.4614	18.9626 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9728	0.9525	0.9166	0.8480	0.7298	0.5602	0.4011	0.4351	0.6545	0.8672	0.9538	0.9778 (94)
Ext temp.	401.5952	455.4433	482.7962	476.3090	420.7190	311.7107	214.0859	223.8468	323.2937	391.2002	387.9888	381.0786 (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	823.3090	804.3792	734.3793	621.2010	480.7196	326.6273	216.9093	227.8826	352.1648	527.6408	690.4260	824.5402 (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	313.7551	234.4849	187.1778	104.3223	44.6405	0.0000	0.0000	0.0000	0.0000	101.5118	217.7547	329.9354 (98)
Space heating per m2												1533.5826 (98)
												(98) / (4) = 24.7113 (99)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)  
 Fraction of space heat from main system(s) 1.0000 (202)  
 Efficiency of main space heating system 1 (in %) 93.5000 (206)  
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)  
 Space heating requirement 1640.1953 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	313.7551	234.4849	187.1778	104.3223	44.6405	0.0000	0.0000	0.0000	0.0000	101.5118	217.7547	329.9354	(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)	335.5669	250.7860	200.1902	111.5746	47.7438	0.0000	0.0000	0.0000	0.0000	108.5688	232.8928	352.8721	(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	89.4451	89.3289	89.1272	88.7623	88.1679	87.3000	87.3000	87.3000	87.3000	88.7113	89.2550	87.3000	(216)
Fuel for water heating, kWh/month	166.4099	146.1628	152.2061	134.7195	131.2435	116.0228	109.1391	122.9226	123.7028	139.8981	149.8816	161.5445	(219)
Water heating fuel used												1653.8532	(219)
Annual totals kWh/year													
Space heating fuel - main system												1640.1953	(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) 307.5579 (232)  
 Total delivered energy for all uses 3719.6729 (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	1640.1953	0.2160	354.2822	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1653.8532	0.2160	357.2323	(264)
Space and water heating			711.5145	(265)
Pumps and fans	118.0666	0.5190	61.2765	(267)
Energy for lighting	307.5579	0.5190	159.6226	(268)
Total CO2, kg/year			932.4136	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0200	(273)

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

DER		15.0200	ZC1
Total Floor Area		62.0600	
Assumed number of occupants	TFA	2.0392	N
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	EF
CO2 emissions from appliances, equation (L14)		17.0069	ZC2
CO2 emissions from cooking, equation (L16)		2.7061	ZC3
Total CO2 emissions		34.7330	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.7330	ZC8

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (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												
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)
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)			7.8600	1.3258	10.4205		(27)					
External Wall	24.6500	7.8600	16.7900	0.1800	3.0222		(29a)					
External Wall to Stairwell	12.6400	2.1200	10.5200	0.1800	1.8936		(29a)					
Plane ceiling	52.0400		52.0400	0.1300	6.7652		(30)					
Sloping ceiling	9.0900		9.0900	0.1300	1.1817		(30)					
Dormer Roof	2.1200		2.1200	0.1300	0.2756		(30)					
Total net area of external elements Aum(A, m2)			100.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.6788	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3993 (36)					
Total fabric heat loss							(33) + (36) = 32.0781 (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	60.3777	60.2133	60.0520	59.2947	59.1531	58.4935	58.4935	58.3713	58.7475	59.1531	59.4397	59.7393 (39)
Average = Sum(39)m / 12 =												59.2941 (39)
HLP	0.9729	0.9702	0.9676	0.9554	0.9532	0.9425	0.9425	0.9406	0.9466	0.9532	0.9578	0.9626 (40)
HLP (average)												0.9554 (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	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	17.4152	15.4680	12.5794	9.5234	7.1189	6.0101	6.4941	8.4413	11.3298	14.3858	16.7904	17.8992	(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	327.9198	325.3461	313.2703	294.3443	275.3591	256.9946	245.4329	251.4626	261.4807	280.5954	302.3801	318.6443	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains							
	m2	Table 6a	g		factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Southwest	7.8600	36.7938	0.6300	0.7000	0.7700	88.3831	(79)						
Solar gains	88.3831	150.5492	205.9879	255.2291	285.8778	283.8105	273.6236	250.7583	223.0414	166.3889	105.8626	75.6375	(83)
Total gains	416.3029	475.8953	519.2582	549.5734	561.2369	540.8051	519.0565	502.2208	484.5221	446.9843	408.2427	394.2818	(84)

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

Temperature during heating periods in the living area from Table 9, Thl (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	71.3793	71.5743	71.7665	72.6830	72.8571	73.6787	73.6787	73.8328	73.3600	72.8571	72.5058	72.1421		
alpha	5.7586	5.7716	5.7844	5.8455	5.8571	5.9119	5.9119	5.9222	5.8907	5.8571	5.8337	5.8095		
util living area	0.9964	0.9915	0.9791	0.9413	0.8455	0.6659	0.4919	0.5285	0.7691	0.9526	0.9917	0.9973	(86)	
MIT	20.0719	20.2216	20.4328	20.6860	20.8813	20.9776	20.9967	20.9951	20.9486	20.7027	20.3392	20.0436	(87)	
Th 2	20.1060	20.1082	20.1104	20.1206	20.1226	20.1315	20.1315	20.1332	20.1281	20.1226	20.1187	20.1146	(88)	
util rest of house	0.9952	0.9889	0.9723	0.9220	0.7988	0.5864	0.3969	0.4321	0.6958	0.9330	0.9885	0.9965	(89)	
MIT 2	18.8692	19.0882	19.3940	19.7561	20.0078	20.1167	20.1303	20.1311	20.0889	19.7863	19.2682	18.8345	(90)	
Living area fraction	fLA = Living area / (4) =												0.3896	(91)
MIT	19.3378	19.5298	19.7988	20.1184	20.3482	20.4521	20.4679	20.4678	20.4239	20.1434	19.6855	19.3056	(92)	
Temperature adjustment													0.0000	
adjusted MIT	19.3378	19.5298	19.7988	20.1184	20.3482	20.4521	20.4679	20.4678	20.4239	20.1434	19.6855	19.3056	(93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)	
Useful gains	413.7615	469.5365	503.3419	506.6761	455.6196	333.5280	225.3002	235.9502	349.9206	417.2816	402.7373	392.4668	(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	907.9474	880.9063	798.6170	665.1934	511.5662	342.3126	226.2449	237.4404	371.5115	564.5200	748.0774	902.3989	(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	367.6743	276.4405	219.6847	114.1324	41.6243	0.0000	0.0000	0.0000	0.0000	109.5453	248.6449	379.3894	(98)	
Space heating													1757.1358	(98)
Space heating per m2													28.3135	(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													1881.3017 (211)
Space heating requirement	367.6743	276.4405	219.6847	114.1324	41.6243	0.0000	0.0000	0.0000	0.0000	109.5453	248.6449	379.3894	(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)	393.6556	295.9749	235.2084	122.1974	44.5656	0.0000	0.0000	0.0000	0.0000	117.2862	266.2151	406.1985	(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	86.7971	86.4425	85.7786	84.4392	82.3941	80.3000	80.3000	80.3000	80.3000	84.2252	86.1051	86.9238	(217)
Fuel for water heating, kWh/month	208.6638	183.0208	191.8950	172.9010	171.5536	155.0353	148.5356	165.5824	167.4111	181.7468	189.7753	203.4665	(219)
Water heating fuel used													2139.5872 (219)
Annual totals kWh/year													
Space heating fuel - main system													1881.3017 (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)													307.5579 (232)
Total delivered energy for all uses													4403.4468 (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	1881.3017	0.2160	406.3612 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2139.5872	0.2160	462.1508 (264)
Space and water heating			868.5120 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	307.5579	0.5190	159.6226 (268)
Total CO2, kg/m2/year			1067.0596 (272)
Emissions per m2 for space and water heating			13.9947 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5721 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9947 * 1.00) + 2.5721 + 0.6272, rounded to 2 d.p.			17.1900 (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	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				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)			3.4500	1.3258	4.5739		(27)
French Door (Uw = 1.40)			4.4100	1.3258	5.8466		(27)
External Wall	24.6500	7.8600	16.7900	0.2500	4.1975	52.8000	886.5120 (29a)
External Wall to Stairwell	12.6400	2.1200	10.5200	0.2000	2.1040	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m2)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.4168		(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (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) =		9807.4620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.0319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3727 (36)
Total fabric heat loss						(33) + (36) =	31.7895 (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	59.0656	58.9409	58.8186	58.2443	58.1369	57.6367	57.6367	57.5440	57.8293	58.1369	58.3542	58.5815 (39)
Average = Sum(39)m / 12 =												58.2438 (39)
HLP	0.9518	0.9497	0.9478	0.9385	0.9368	0.9287	0.9287	0.9272	0.9318	0.9368	0.9403	0.9439 (40)
HLP (average)												0.9385 (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	701.0015	674.9064	651.4898	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	156.0173	203.9893	182.7373	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												542.7439 (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	39.0043	50.9973	45.6843	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												135.6860 (107)
Space cooling per m2												2.1864 (108)
Energy for space heating												29.7294 (99)
Energy for space cooling												2.1864 (108)
Total												31.9158 (109)
Dwelling Fabric Energy Efficiency (DFEE)												31.9 (109)

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# 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 infiltr 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)
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)			7.8600	1.3258	10.4205		(27)					
External Wall	24.6500	7.8600	16.7900	0.1800	3.0222		(29a)					
External Wall to Stairwell	12.6400	2.1200	10.5200	0.1800	1.8936		(29a)					
Plane ceiling	52.0400		52.0400	0.1300	6.7652		(30)					
Sloping ceiling	9.0900		9.0900	0.1300	1.1817		(30)					
Dormer Roof	2.1200		2.1200	0.1300	0.2756		(30)					
Total net area of external elements Aum(A, m2)			100.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.6788	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3993 (36)					
Total fabric heat loss							(33) + (36) = 32.0781 (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 =	60.3777	60.2133	60.0520	59.2947	59.1531	58.4935	58.4935	58.3713	58.7475	59.1531	59.4397	59.7393 (39)
HLP	0.9729	0.9702	0.9676	0.9554	0.9532	0.9425	0.9425	0.9406	0.9466	0.9532	0.9578	0.9626 (40)
HLP (average)												0.9554 (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	29.5009	42.6789	37.5380	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												109.7177 (107)
Space cooling per m2												1.7679 (108)
Energy for space heating												31.6673 (99)
Energy for space cooling												1.7679 (108)
Total												33.4353 (109)
Target Fabric Energy Efficiency (TFEE)												38.5 (109)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (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	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)			3.4500	1.3258	4.5739		(27)
French Door (Uw = 1.40)			4.4100	1.3258	5.8466		(27)
External Wall	24.6500	7.8600	16.7900	0.2500	4.1975	52.8000	886.5120 (29a)
External Wall to Stairwell	12.6400	2.1200	10.5200	0.2000	2.1040	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m2)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.4168		(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (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) =	9807.4620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.0319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3727 (36)
Total fabric heat loss						(33) + (36) =	31.7895 (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	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532 (39)
Average = Sum(39)m / 12 =												55.8532 (39)
HLP	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000 (40)
HLP (average)												0.9000 (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	43.5380	38.6701	31.4486	23.8086	17.7972	15.0252	16.2352	21.1032	28.3246	35.9646	41.9760	44.7481 (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	467.3968	463.3720	445.2258	417.3871	389.1884	363.9234	349.2114	356.6952	372.7796	400.8070	431.8101	454.9735 (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						
Southwest	3.4500	40.9830	0.4300	0.0000	0.7700	46.8147 (79)						
Southwest	4.4100	40.9830	0.4300	0.0000	0.7700	59.8414 (79)						
Solar gains	106.6561	169.2206	227.6303	297.0548	322.0236	333.6786	318.3173	293.2245	261.4361	195.4217	130.8501	90.4138 (83)
Total gains	574.0529	632.5926	672.8560	714.4419	711.2120	697.6020	667.5287	649.9197	634.2157	596.2287	562.6601	545.3873 (84)

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

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	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760 (85)
alpha	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517
util living area	0.9429	0.9168	0.8650	0.7642	0.6223	0.4401	0.2835	0.2911	0.5113	0.7643	0.9030	0.9513 (86)
MIT	20.1583	20.3101	20.5442	20.7803	20.9267	20.9868	20.9985	20.9984	20.9752	20.8165	20.4647	20.1071 (87)
Th 2	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675 (88)
util rest of house	0.9332	0.9033	0.8438	0.7299	0.5724	0.3778	0.2146	0.2204	0.4462	0.7227	0.8849	0.9427 (89)
MIT 2	19.0713	19.2838	19.6074	19.9191	20.0967	20.1583	20.1670	20.1669	20.1487	19.9711	19.5046	18.9994 (90)
Living area fraction	19.4948	19.6837	19.9724	20.2547	20.4201	20.4811	20.4910	20.4909	20.4707	20.3005	19.8787	19.4310 (92)
Temperature adjustment												0.0000 (91)
adjusted MIT	19.4948	19.6837	19.9724	20.2547	20.4201	20.4811	20.4910	20.4909	20.4707	20.3005	19.8787	19.4310 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	530.3608	565.7443	564.0506	524.1489	418.1562	280.0862	161.1760	161.1380	298.3029	435.0989	493.8587	509.2041 (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	826.3391	808.9607	724.5489	600.6826	442.3630	283.7959	161.4693	161.4638	305.5586	497.1214	680.2185	822.7718 (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	220.2078	163.4414	119.4108	55.1042	18.0098	0.0000	0.0000	0.0000	0.0000	46.1448	134.1791	233.2944 (98)
Space heating												989.7924 (98)
RHI space heating demand												990 (98)





# 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)
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	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)			3.4500	1.3258	4.5739		(27)
French Door (Uw = 1.40)			4.4100	1.3258	5.8466		(27)
External Wall	24.6500	7.8600	16.7900	0.2500	4.1975	52.8000	886.5120 (29a)
External Wall to Stairwell	12.6400	2.1200	10.5200	0.2000	2.1040	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m2)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.4168		(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (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) =			9807.4620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.0319 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3727 (36)
Total fabric heat loss						(33) + (36) =	31.7895 (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 =	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532 (39)

  

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)

# 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	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	43.5380	38.6701	31.4486	23.8086	17.7972	15.0252	16.2352	21.1032	28.3246	35.9646	41.9760	44.7481 (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	467.3968	463.3720	445.2258	417.3871	389.1884	363.9234	349.2114	356.6952	372.7796	400.8070	431.8101	454.9735 (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							
Southwest	3.4500	36.7938	0.4300	0.0000	0.7700	42.0294 (79)						
Southwest	4.4100	36.7938	0.4300	0.0000	0.7700	53.7246 (79)						
Solar gains	95.7540	163.1044	223.1666	276.5142	309.7190	307.4792	296.4428	271.6706	241.6422	180.2651	114.6912	81.9454 (83)
Total gains	563.1507	626.4764	668.3924	693.9013	698.9074	671.4027	645.6542	628.3658	614.4218	581.0721	546.5013	536.9189 (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	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760
alpha	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517
util living area	0.9501	0.9233	0.8784	0.7988	0.6748	0.5147	0.3767	0.4034	0.5920	0.8094	0.9209	0.9579 (86)
MIT	20.0931	20.2684	20.4921	20.7228	20.8909	20.9729	20.9943	20.9922	20.9507	20.7480	20.3773	20.0331 (87)
Th 2	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675 (88)
util rest of house	0.9416	0.9108	0.8592	0.7681	0.6290	0.4536	0.3072	0.3327	0.5309	0.7742	0.9060	0.9505 (89)
MIT 2	18.9785	19.2252	19.5360	19.8457	20.0561	20.1460	20.1644	20.1630	20.1252	19.8853	19.3836	18.8935 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.4128	19.6317	19.9085	20.1875	20.3814	20.4682	20.4877	20.4861	20.4468	20.2214	19.7708	19.3375 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4128	19.6317	19.9085	20.1875	20.3814	20.4682	20.4877	20.4861	20.4468	20.2214	19.7708	19.3375 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9324	0.9016	0.8526	0.7689	0.6412	0.4760	0.3341	0.3601	0.5520	0.7767	0.8978	0.9417 (94)
Ext temp.	525.0665	564.8488	569.8749	533.5290	448.1194	319.6143	215.7362	226.2521	339.1693	451.3091	490.6544	505.6073 (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	844.0985	822.8113	748.9087	630.4410	484.8837	327.7561	217.1422	228.2216	354.4905	537.3875	707.7025	845.4781 (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 per m2	237.3599	173.3508	133.2011	69.7767	27.3526	0.0000	0.0000	0.0000	0.0000	64.0423	156.2747	252.8639 (98)
												1114.2220 (98)
												(98) / (4) = 17.9539 (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													1191.6812 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	237.3599	173.3508	133.2011	69.7767	27.3526	0.0000	0.0000	0.0000	0.0000	64.0423	156.2747	252.8639	(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)	253.8608	185.4019	142.4611	74.6275	29.2541	0.0000	0.0000	0.0000	0.0000	68.4944	167.1387	270.4427	(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	89.2393	89.0970	88.8566	88.4525	87.8942	87.3000	87.3000	87.3000	87.3000	88.3635	88.9954	87.3000	(216)
Fuel for water heating, kWh/month	166.7936	146.5432	152.6697	135.1914	131.6522	116.0228	109.1391	122.9226	123.7028	140.4487	150.3186	161.8905	(219)
Water heating fuel used													1657.2952 (219)
Annual totals kWh/year													
Space heating fuel - main system													1191.6812 (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)													307.5579 (232)
Total delivered energy for all uses													3274.6009 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1191.6812	3.4800	41.4705 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1657.2952	3.4800	57.6739 (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	307.5579	13.1900	40.5669 (250)
Additional standing charges			120.0000 (251)
Total energy cost			275.2842 (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] =	1.0799 (257)
SAP value		84.9347
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	1191.6812	0.2160	257.4031 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1657.2952	0.2160	357.9758 (264)
Space and water heating			615.3789 (265)
Pumps and fans	118.0666	0.5190	61.2765 (267)
Energy for lighting	307.5579	0.5190	159.6226 (268)
Total kg/year			836.2780 (272)
CO2 emissions per m2			13.4800 (273)
EI value			89.5329
EI rating			90 (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	$3.48 / 0.8828 = 3.942$ , stars = 4
Water heating environmental impact	$0.216 / 0.8828 = 0.2447$ , stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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# 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)							
Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.7000	Apr 4.2000	May 4.2000	Jun 3.7000	Jul 3.8000	Aug 3.8000	Sep 4.0000	Oct 4.2000	Nov 4.3000	Dec 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)			3.4500	1.3258	4.5739		(27)					
French Door (Uw = 1.40)			4.4100	1.3258	5.8466		(27)					
External Wall	24.6500	7.8600	16.7900	0.2500	4.1975	52.8000	886.5120 (29a)					
External Wall to Stairwell	12.6400	2.1200	10.5200	0.2000	2.1040	52.8000	555.4560 (29a)					
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)					
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)					
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)					
Total net area of external elements Aum(A, m2)			100.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.4168		(33)					
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (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) =	9807.4620 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.0319 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3727 (36)					
Total fabric heat loss						(33) + (36) =	31.7895 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.0638	Feb 24.0638	Mar 24.0638	Apr 24.0638	May 24.0638	Jun 24.0638	Jul 24.0638	Aug 24.0638	Sep 24.0638	Oct 24.0638	Nov 24.0638	Dec 24.0638 (38)
Heat transfer coeff	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532	55.8532 (39)
Average = Sum(39)m / 12 =												55.8532 (39)
HLP	Jan 0.9000	Feb 0.9000	Mar 0.9000	Apr 0.9000	May 0.9000	Jun 0.9000	Jul 0.9000	Aug 0.9000	Sep 0.9000	Oct 0.9000	Nov 0.9000	Dec 0.9000 (40)
HLP (average)												0.9000 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

# 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	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	43.5380	38.6701	31.4486	23.8086	17.7972	15.0252	16.2352	21.1032	28.3246	35.9646	41.9760	44.7481 (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	467.3968	463.3720	445.2258	417.3871	389.1884	363.9234	349.2114	356.6952	372.7796	400.8070	431.8101	454.9735 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m <sup>2</sup>	Table 6a	W/m <sup>2</sup>	or Table 6b	or Table 6c	factor	W					
Southwest	3.4500	40.9830	0.4300		0.0000	0.7700	46.8147 (79)					
Southwest	4.4100	40.9830	0.4300		0.0000	0.7700	59.8414 (79)					
Solar gains	106.6561	169.2206	227.6303	297.0548	322.0236	333.6786	318.3173	293.2245	261.4361	195.4217	130.8501	90.4138 (83)
Total gains	574.0529	632.5926	672.8560	714.4419	711.2120	697.6020	667.5287	649.9197	634.2157	596.2287	562.6601	545.3873 (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	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760	48.7760
alpha	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517	4.2517
util living area	0.9429	0.9168	0.8650	0.7642	0.6223	0.4401	0.2835	0.2911	0.5113	0.7643	0.9030	0.9513 (86)	
MIT	20.1583	20.3101	20.5442	20.7803	20.9267	20.9868	20.9985	20.9984	20.9752	20.8165	20.4647	20.1071 (87)	
Th 2	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675	20.1675 (88)	
util rest of house	0.9332	0.9033	0.8438	0.7299	0.5724	0.3778	0.2146	0.2204	0.4462	0.7227	0.8849	0.9427 (89)	
MIT 2	19.0713	19.2838	19.6074	19.9191	20.0967	20.1583	20.1670	20.1669	20.1487	19.9711	19.5046	18.9994 (90)	
Living area fraction									fLA = Living area / (4) =			0.3896 (91)	
MIT	19.4948	19.6837	19.9724	20.2547	20.4201	20.4811	20.4910	20.4909	20.4707	20.3005	19.8787	19.4310 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.4948	19.6837	19.9724	20.2547	20.4201	20.4811	20.4910	20.4909	20.4707	20.3005	19.8787	19.4310 (93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9239	0.8943	0.8383	0.7336	0.5879	0.4015	0.2415	0.2479	0.4703	0.7298	0.8777	0.9337 (94)
Useful gains	530.3608	565.7443	564.0506	524.1489	418.1562	280.0862	161.1760	161.1380	298.3029	435.0989	493.8587	509.2041 (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	826.3391	808.9607	724.5489	600.6826	442.3630	283.7959	161.4693	161.4638	305.5586	497.1214	680.2185	822.7718 (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	220.2078	163.4414	119.4108	55.1042	18.0098	0.0000	0.0000	0.0000	0.0000	46.1448	134.1791	233.2944 (98)
Space heating												989.7924 (98)
Space heating per m <sup>2</sup>												(98) / (4) = 15.9490 (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													1058.6015 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	220.2078	163.4414	119.4108	55.1042	18.0098	0.0000	0.0000	0.0000	0.0000	46.1448	134.1791	233.2944	(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)	235.5164	174.8037	127.7121	58.9350	19.2618	0.0000	0.0000	0.0000	0.0000	49.3527	143.5070	249.5127	(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	89.1816	89.0504	88.7694	88.2847	87.7177	87.3000	87.3000	87.3000	87.3000	88.1448	88.8736	87.3000	(216)
Fuel for water heating, kWh/month	166.9016	146.6198	152.8196	135.4483	131.9170	116.0228	109.1391	122.9226	123.7028	140.7973	150.5247	162.0008	(219)
Water heating fuel used													1658.8163 (219)
Annual totals kWh/year													
Space heating fuel - main system													1058.6015 (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)													307.5579 (232)
Total delivered energy for all uses													3143.0423 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1058.6015	3.9200	41.4972	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1658.8163	3.9200	65.0256	(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	307.5579	16.9600	52.1618	(250)
Additional standing charges			88.0000	(251)
Total energy cost			266.7087	(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	1058.6015	0.2160	228.6579	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1658.8163	0.2160	358.3043	(264)
Space and water heating			586.9622	(265)
Pumps and fans	118.0666	0.5190	61.2765	(267)
Energy for lighting	307.5579	0.5190	159.6226	(268)
Total kg/year			807.8614	(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	1058.6015	1.2200	1291.4938	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1658.8163	1.2200	2023.7559	(264)
Space and water heating			3315.2497	(265)
Pumps and fans	118.0666	3.0700	362.4644	(267)
Energy for lighting	307.5579	3.0700	944.2028	(268)
Primary energy kWh/year			4621.9169	(272)
Primary energy kWh/m2/year			74.4750	(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 85  
 Current environmental impact rating: B 90

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

Potential energy efficiency rating: B 85  
 Potential environmental impact rating: B 90

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	£72	£72	£0
Mains gas	£195	£195	£0
Space heating	£150	£150	£0
Water heating	£65	£65	£0
Lighting	£52	£52	£0
Total cost of fuels	£267	£267	£0
Total cost of uses	£267	£267	£0
Delivered energy	51 kWh/m <sup>2</sup>	51 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	13 kg/m <sup>2</sup>	13 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	74 kWh/m <sup>2</sup>	74 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

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014  
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No improvements selected / applicable  
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# 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	North West
Overshading	Average or unknown
Thermal mass parameter	158.0 (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	31.79 (37)
Summer heat loss coefficient	224.30 (P2)

#### Overhangs

Orientation	Ratio	Z_overhangs	Overhang type	
South West	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South West	3.4500	122.3147	0.4300	0.0000	0.9000	163.3084
South West	4.4100	122.3147	0.4300	0.0000	0.9000	208.7508
total:						372.0592

	Jun	Jul	Aug	
Solar gains	390	372	343	(P4)
Internal gains	361	346	354	
Total summer gains	751	718	696	(P5)
Summer gain/loss ratio	3.35	3.20	3.10	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 158.0)	0.89	0.89	0.89	
Threshold temperature	19.64	21.70	21.60	(P7)
Likelihood of high internal temperature	Not significant		Slight	
Assessment of likelihood of high internal temperature:	Slight			