

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-014			Issued on Date	12/02/2020
Assessment Reference	014	Prop Type Ref	GFF Semi		
Property	Plot 014, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	16.60	TER	18.44
Environmental	89 B	% DER<TER	9.96		
CO <sub>2</sub> Emissions (t/year)	0.87	DFEE	37.90	TFEE	44.01
General Requirements Compliance	Pass	% DFEE<TFEE	13.88		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client	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

Ground-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) 18.44 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 16.60 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)44.0 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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof (no roof)			
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): Medium OK

Based on:

Overshading: Average

Windows facing South West: 6.51 m<sup>2</sup>, No overhang

Air change rate: 2.00 ach

Blinds/curtains: None

#### 10 Key features

Party wall U-value 0.00 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 (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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	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	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:												0.5000 (25)
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 m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
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)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.7833		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.5423 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Average = Sum(39)m / 12 =	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157 (39)
HLP	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832 (40)
HLP (average)												0.9832 (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)

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

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)	
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)	
Solar input (sum of months) = Sum(63)m =	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)	
Total per year (kWh/year) = Sum(64)m =	1464.6982 (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	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	Specific data	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	g	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
Southwest	3.9900	36.7938	0.4300	0.0000	0.7700	48.6079 (79)							
Southwest	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)							
Solar gains	79.3077	135.0903	184.8364	229.0213	256.5230	254.6679	245.5271	225.0096	200.1388	149.3036	94.9923	67.8708	(83)
Total gains	397.1196	450.8057	488.9106	514.5954	523.5684	503.8588	483.1710	468.2091	452.9177	420.7713	387.7931	376.4246	(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	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	
alpha	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	
util living area	0.9962	0.9919	0.9815	0.9522	0.8757	0.7204	0.5451	0.5838	0.8115	0.9606	0.9920	0.9972	(86)
MIT	19.9732	20.1184	20.3330	20.5910	20.8205	20.9546	20.9916	20.9879	20.9119	20.6205	20.2366	19.9297	(87)
Th 2	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	(88)
util rest of house	0.9951	0.9895	0.9756	0.9363	0.8346	0.6391	0.4387	0.4770	0.7422	0.9443	0.9892	0.9963	(89)
MIT 2	18.7252	18.9363	19.2465	19.6114	19.9155	20.0650	20.0939	20.0919	20.0255	19.6579	19.1095	18.6619	(90)
Living area fraction	fLA = Living area / (4) =												0.3896 (91)
MIT	19.2114	19.3969	19.6698	19.9931	20.2681	20.4116	20.4437	20.4410	20.3709	20.0329	19.5487	19.1559	(92)
Temperature adjustment													0.0000
adjusted MIT	19.2114	19.3969	19.6698	19.9931	20.2681	20.4116	20.4437	20.4410	20.3709	20.0329	19.5487	19.1559	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9936	0.9870	0.9722	0.9341	0.8432	0.6689	0.4803	0.5187	0.7650	0.9429	0.9869	0.9951	(94)
Useful gains	394.5735	444.9436	475.2954	480.6958	441.4988	337.0189	232.0738	242.8575	346.4918	396.7243	382.7107	374.5734	(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	909.8325	884.5368	803.5662	676.8530	522.7892	354.6000	234.5236	246.5636	382.6210	575.5564	759.5631	912.5436	(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	383.3526	295.4066	244.2335	141.2332	60.4801	0.0000	0.0000	0.0000	0.0000	133.0511	271.3337	400.2498	(98)
Space heating													1929.3407 (98)
Space heating per m <sup>2</sup>													(98) / (4) = 31.0883 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2063.4660 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	383.3526	295.4066	244.2335	141.2332	60.4801	0.0000	0.0000	0.0000	0.0000	133.0511	271.3337	400.2498	(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)	410.0028	315.9429	261.2123	151.0516	64.6846	0.0000	0.0000	0.0000	0.0000	142.3007	290.1965	428.0747	(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	89.5816	89.4945	89.3307	89.0042	88.3726	87.3000	87.3000	87.3000	87.3000	88.9269	89.4177	87.3000	(216)
Fuel for water heating, kWh/month	166.1562	145.8922	151.8594	134.3535	130.9394	116.0228	109.1391	122.9226	123.7028	139.5589	149.6089	161.3142	(219)
Water heating fuel used													1651.4700 (219)
Annual totals kWh/year													
Space heating fuel - main system													2063.4660 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													4154.2752 (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	2063.4660	0.2160	445.7087	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1651.4700	0.2160	356.7175	(264)
Space and water heating			802.4262	(265)
Pumps and fans	118.7996	0.5190	61.6570	(267)
Energy for lighting	320.5396	0.5190	166.3601	(268)
Total CO2, kg/year			1030.4432	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6000	(273)

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

DER			16.6000 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			36.3130 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			36.3130 ZC8

# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 148.3234 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3848	(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) =	0.3271 (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	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
Effective ac	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			6.5100	1.3258	8.6307		(27)
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)
External Wall	43.6300	6.5100	37.1200	0.1800	6.6816		(29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.5467		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6119 (36)
Total fabric heat loss							(33) + (36) = 35.1586 (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	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Average = Sum(39)m / 12 =	63.8890	63.7237	63.5617	62.8006	62.6582	61.9954	61.9954	61.8726	62.2507	62.6582	62.9463	63.2474 (39)
	62.7999 (39)											
HLP	1.0295	1.0268	1.0242	1.0119	1.0096	0.9990	0.9990	0.9970	1.0031	1.0096	1.0143	1.0191 (40)
HLP (average)	1.0119 (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												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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)
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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)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							
Southwest	6.5100	36.7938	0.6300	0.7000	0.7700	73.2028 (79)						
Solar gains	73.2028	124.6915	170.6083	211.3920	236.7767	235.0644	226.6272	207.6891	184.7327	137.8107	87.6801	62.6464 (83)
Total gains	401.8577	450.6905	484.4096	506.1383	512.4362	492.3127	472.3341	459.5080	446.6917	419.0133	390.7689	382.0462 (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	67.4564	67.6314	67.8038	68.6255	68.7814	69.5169	69.5169	69.6548	69.2317	68.7814	68.4667	68.1407
alpha	5.4971	5.5088	5.5203	5.5750	5.5854	5.6345	5.6345	5.6437	5.6154	5.5854	5.5644	5.5427
util living area	0.9971	0.9939	0.9862	0.9628	0.8970	0.7450	0.5662	0.6029	0.8317	0.9679	0.9937	0.9978 (86)
MIT	19.9691	20.1052	20.3124	20.5768	20.8089	20.9533	20.9916	20.9882	20.9098	20.6179	20.2449	19.9437 (87)
Th 2	20.0588	20.0611	20.0632	20.0734	20.0753	20.0842	20.0842	20.0859	20.0808	20.0753	20.0714	20.0674 (88)
util rest of house	0.9961	0.9919	0.9814	0.9489	0.8581	0.6616	0.4543	0.4915	0.7622	0.9533	0.9913	0.9971 (89)
MIT 2	18.6844	18.8842	19.1860	19.5700	19.8818	20.0516	20.0809	20.0808	20.0083	19.6334	19.0962	18.6536 (90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)
MIT	19.1849	19.3599	19.6249	19.9623	20.2430	20.4029	20.4358	20.4343	20.3595	20.0170	19.5437	19.1563 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1849	19.3599	19.6249	19.9623	20.2430	20.4029	20.4358	20.4343	20.3595	20.0170	19.5437	19.1563 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	399.8126	446.1678	474.0032	479.2860	443.7799	340.8561	235.3024	245.9092	350.8248	398.9573	386.6390	380.5459 (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	950.9836	921.4405	834.2397	694.7193	535.2887	359.7557	237.7998	249.6150	389.6603	590.0514	783.2876	945.9468 (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	410.0713	319.3833	268.0159	155.1120	68.0825	0.0000	0.0000	0.0000	0.0000	142.1740	285.5870	420.6582 (98)
Space heating												2069.0842 (98)
Space heating per m2												33.3401 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												2215.2936 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	410.0713	319.3833	268.0159	155.1120	68.0825	0.0000	0.0000	0.0000	0.0000	142.1740	285.5870	420.6582 (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)	439.0485	341.9521	286.9550	166.0728	72.8935	0.0000	0.0000	0.0000	0.0000	152.2205	305.7676	450.3836 (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	87.0459	86.7841	86.2714	85.2038	83.3264	80.3000	80.3000	80.3000	80.3000	84.8658	86.4430	80.3000 (216)
Fuel for water heating, kWh/month	208.0674	182.3004	190.7991	171.3494	169.6343	155.0353	148.5356	165.5824	167.4111	180.3749	189.0335	202.9261 (219)
Water heating fuel used												2131.0493 (219)
Annual totals kWh/year												
Space heating fuel - main system												2215.2936 (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												4741.8825 (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	2215.2936	0.2160	478.5034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2131.0493	0.2160	460.3067 (264)
Space and water heating			938.8101 (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			1144.0951 (272)
Emissions per m2 for space and water heating			15.1275 (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) = (15.1275 * 1.00) + 2.6806 + 0.6272, rounded to 2 d.p.			18.4400 (273)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3348	(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) =	0.2846 (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	0.3629	0.3558	0.3487	0.3131	0.3060	0.2704	0.2704	0.2633	0.2846	0.3060	0.3202	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5366	0.5366	0.5347	0.5405	0.5468	0.5513	0.5559 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
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)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.7833		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			30.0000	1861.8000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12032.2960 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 193.8817 (35)  
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.7591 (36)  
 Total fabric heat loss (33) + (36) = 36.5423 (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)												
(38)m	27.6961	27.5710	27.4483	26.8722	26.7644	26.2625	26.2625	26.1696	26.4558	26.7644	26.9824	27.2104 (38)
Heat transfer coeff	64.2385	64.1133	63.9906	63.4145	63.3067	62.8049	62.8049	62.7119	62.9982	63.3067	63.5248	63.7527 (39)
Average = Sum(39)m / 12 =	63.4140 (39)											
HLP	1.0351	1.0331	1.0311	1.0218	1.0201	1.0120	1.0120	1.0105	1.0151	1.0201	1.0236	1.0273 (40)
HLP (average)	1.0218 (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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	(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	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-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)	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	(72)
Total internal gains	288.3495	286.9485	276.7473	260.2031	242.9449	226.8776	216.8473	220.4571	229.3433	246.0081	265.0553	279.7805	(73)

#### 6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
Southwest			3.9900	36.7938	0.4300		0.0000		0.7700	48.6079	(79)		
Southwest			2.5200	36.7938	0.4300		0.0000		0.7700	30.6997	(79)		
Solar gains	79.3077	135.0903	184.8364	229.0213	256.5230	254.6679	245.5271	225.0096	200.1388	149.3036	94.9923	67.8708	(83)
Total gains	367.6572	422.0388	461.5837	489.2244	499.4679	481.5455	462.3744	445.4667	429.4821	395.3116	360.0476	347.6513	(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	52.0297	52.1312	52.2311	52.7057	52.7954	53.2173	53.2173	53.2961	53.0540	52.7954	52.6142	52.4260		
alpha	4.4686	4.4754	4.4821	4.5137	4.5197	4.5478	4.5478	4.5531	4.5369	4.5197	4.5076	4.4951		
util living area	0.9945	0.9891	0.9775	0.9481	0.8791	0.7389	0.5731	0.6129	0.8243	0.9576	0.9895	0.9957		(86)
MIT	19.6650	19.8389	20.0993	20.4254	20.7165	20.9124	20.9785	20.9707	20.8470	20.4699	20.0031	19.6291		(87)
Th 2	20.0542	20.0559	20.0575	20.0652	20.0666	20.0733	20.0733	20.0746	20.0708	20.0666	20.0637	20.0607		(88)
util rest of house	0.9931	0.9863	0.9714	0.9330	0.8420	0.6617	0.4635	0.5046	0.7612	0.9423	0.9863	0.9946		(89)
MIT 2	18.8329	19.0068	19.2655	19.5888	19.8599	20.0257	20.0661	20.0638	19.9774	19.6370	19.1772	18.8023		(90)
Living area fraction									fLA = Living area / (4) =			0.3896		(91)
MIT	19.1571	19.3310	19.5904	19.9148	20.1937	20.3712	20.4215	20.4171	20.3162	19.9615	19.4990	19.1244		(92)
Temperature adjustment												0.0000		
adjusted MIT	19.1571	19.3310	19.5904	19.9148	20.1937	20.3712	20.4215	20.4171	20.3162	19.9615	19.4990	19.1244		(93)

#### 8. Space heating requirement

Utilisation	0.9913	0.9836	0.9677	0.9302	0.8477	0.6882	0.5061	0.5464	0.7797	0.9402	0.9839	0.9931		(94)
Useful gains	364.4567	415.1023	446.6800	455.0523	423.3838	331.4137	234.0021	243.3950	334.8466	371.6703	354.2335	345.2530		(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	954.3992	925.2199	837.6617	698.4952	537.7067	362.4584	240.0116	251.9232	391.6119	592.6471	787.6405	951.4734		(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	438.9173	342.7990	290.8904	175.2789	85.0562	0.0000	0.0000	0.0000	0.0000	164.4067	312.0530	451.0279		(98)
Space heating												2260.4296		(98)
Space heating per m2										(98) / (4) =		36.4233		(99)

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	590.3658	464.7561	476.6108	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8511	0.9138	0.8991	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	502.4783	424.6873	428.5039	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	639.9081	616.0797	597.8418	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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	98.9495	142.3960	125.9874	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													367.3328 (104)
Cooled fraction													1.0000 (105)
Intermittency factor (Table 10b)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.7374	35.5990	31.4968	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													91.8332 (107)
Space cooling per m2													1.4797 (108)
Energy for space heating													36.4233 (99)
Energy for space cooling													1.4797 (108)
Total													37.9030 (109)
Dwelling Fabric Energy Efficiency (DFEE)													37.9 (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)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3848 (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) =	0.3271 (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	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (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)
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)
External Wall	43.6300	6.5100	37.1200	0.1800	6.6816		(29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)					27.5467		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6119 (36)
Total fabric heat loss							(33) + (36) = 35.1586 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	63.8890	63.7237	63.5617	62.8006	62.6582	61.9954	61.9954	61.8726	62.2507	62.6582	62.9463	63.2474 (39)
Average = Sum(39)m / 12 =												62.7999 (39)
HLP	1.0295	1.0268	1.0242	1.0119	1.0096	0.9990	0.9990	0.9970	1.0031	1.0096	1.0143	1.0191 (40)
HLP (average)												1.0119 (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)
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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	(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	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-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)	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	(72)
Total internal gains	288.3495	286.9485	276.7473	260.2031	242.9449	226.8776	216.8473	220.4571	229.3433	246.0081	265.0553	279.7805	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
Southwest	6.5100	36.7938	0.6300	0.7000	0.7700	73.2028	(79)						
Solar gains	73.2028	124.6915	170.6083	211.3920	236.7767	235.0644	226.6272	207.6891	184.7327	137.8107	87.6801	62.6464	(83)
Total gains	361.5524	411.6400	447.3556	471.5951	479.7216	461.9420	443.4745	428.1462	414.0760	383.8187	352.7354	342.4268	(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)	67.4564	67.6314	67.8038	68.6255	68.7814	69.5169	69.5169	69.6548	69.2317	68.7814	68.4667	68.1407	(85)
tau	5.4971	5.5088	5.5203	5.5750	5.5854	5.6345	5.6345	5.6437	5.6154	5.5854	5.5644	5.5427	
util living area	0.9983	0.9961	0.9904	0.9722	0.9174	0.7780	0.5991	0.6409	0.8639	0.9780	0.9962	0.9987	(86)
MIT	19.9076	20.0465	20.2588	20.5322	20.7785	20.9418	20.9890	20.9841	20.8884	20.5709	20.1876	19.8829	(87)
Th 2	20.0588	20.0611	20.0632	20.0734	20.0753	20.0842	20.0842	20.0859	20.0808	20.0753	20.0714	20.0674	(88)
util rest of house	0.9977	0.9948	0.9870	0.9614	0.8835	0.6963	0.4827	0.5254	0.8003	0.9672	0.9947	0.9983	(89)
MIT 2	19.0592	19.1994	19.4118	19.6879	19.9185	20.0556	20.0812	20.0810	20.0171	19.7298	19.3489	19.0416	(90)
Living area fraction	19.3897	19.5294	19.7418	20.0169	20.2536	20.4009	20.4349	20.4329	20.3566	20.0575	19.6757	19.3694	(91)
MIT	19.3897	19.5294	19.7418	20.0169	20.2536	20.4009	20.4349	20.4329	20.3566	20.0575	19.6757	19.3694	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3897	19.5294	19.7418	20.0169	20.2536	20.4009	20.4349	20.4329	20.3566	20.0575	19.6757	19.3694	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9971	0.9938	0.9855	0.9606	0.8910	0.7266	0.5286	0.5709	0.8217	0.9670	0.9938	0.9979	(94)	
Useful gains	360.5211	409.0817	440.8512	453.0096	427.4105	335.6390	234.4034	244.4403	340.2342	371.1401	350.5476	341.6969	(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	964.0680	932.2418	841.6719	698.1459	535.9532	359.6291	237.7451	249.5259	389.4771	592.5919	791.5926	959.4246	(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	449.0389	351.5636	298.2106	176.4981	80.7558	0.0000	0.0000	0.0000	0.0000	164.7602	317.5524	459.5894	(98)	
Space heating												2297.9690	(98)	
Space heating per m2												(98) / (4) =	37.0282	(99)

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	582.7564	458.7657	470.2318	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8724	0.9352	0.9218	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	508.4039	429.0471	433.4718	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	616.9949	593.9890	577.5970	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	78.1856	122.7168	107.2292	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												308.1315	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	19.5464	30.6792	26.8073	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													77.0329 (107)
Space cooling per m2													1.2413 (108)
Energy for space heating													37.0282 (99)
Energy for space cooling													1.2413 (108)
Total													38.2694 (109)
Target Fabric Energy Efficiency (TFEE)													44.0 (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)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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	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:												
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)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.7833		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.5423 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157 (39)
Average = Sum(39)m / 12 =												61.0157 (39)
HLP	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832 (40)
HLP (average)												0.9832 (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
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)
	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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

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	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	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	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	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	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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (64)	
RHI water heating demand													1465 (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	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	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	Specific data	FF	Access	Gains							
	m2	Table 6a	g		factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Southwest	3.9900	40.9830	0.4300	0.0000	0.7700	54.1422 (79)							
Southwest	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (79)							
Solar gains	88.3373	140.1560	188.5335	246.0339	266.7142	276.3674	263.6445	242.8615	216.5330	161.8569	108.3758	74.8847	(83)
Total gains	557.5718	605.1602	635.0866	664.4260	656.6538	640.9250	613.5411	600.4475	590.5081	564.1819	541.9577	531.7469	(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	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	
alpha	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	
util living area	0.9803	0.9684	0.9392	0.8659	0.7303	0.5247	0.3375	0.3448	0.6013	0.8593	0.9595	0.9839	(86)
MIT	20.2620	20.3772	20.5754	20.7919	20.9356	20.9911	20.9994	20.9993	20.9819	20.8337	20.5198	20.2235	(87)
Th 2	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	(88)
util rest of house	0.9749	0.9600	0.9231	0.8322	0.6705	0.4440	0.2483	0.2537	0.5188	0.8169	0.9470	0.9794	(89)
MIT 2	19.1421	19.3059	19.5836	19.8713	20.0413	20.0924	20.0972	20.0972	20.0861	19.9290	19.5106	19.0872	(90)
Living area fraction	19.5785	19.7233	19.9701	20.2300	20.3897	20.4426	20.4487	20.4487	20.4351	20.2815	19.9038	19.5300	(91)
MIT	19.5785	19.7233	19.9701	20.2300	20.3897	20.4426	20.4487	20.4487	20.4351	20.2815	19.9038	19.5300	(92)
Temperature adjustment													0.0000
adjusted MIT	19.5785	19.7233	19.9701	20.2300	20.3897	20.4426	20.4487	20.4487	20.4351	20.2815	19.9038	19.5300	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9710	0.9558	0.9204	0.8376	0.6908	0.4753	0.2831	0.2892	0.5504	0.8264	0.9438	0.9759	(94)
Ext temp.	541.4299	578.4163	584.5540	556.5162	453.6030	304.6180	173.6802	173.6623	325.0347	466.2372	511.4880	518.9331	(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	907.8202	886.1508	791.3774	654.6995	481.3981	307.6749	173.8166	173.8142	331.6266	541.9105	744.6219	904.8608	(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	272.5944	206.7975	153.8766	70.6920	20.6796	0.0000	0.0000	0.0000	0.0000	56.3009	167.8564	287.1302	(98)
RHI space heating demand													1235.9275 (98)
													1236 (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)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.7833		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.5423 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157 (39)
Average = Sum(39)m / 12 =												61.0157 (39)
HLP	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832 (40)
HLP (average)												0.9832 (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
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)
	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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	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	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	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	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	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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (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	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	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	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	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	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	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	-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	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	456.8622	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Southwest		3.9900	36.7938	0.4300	0.0000	0.7700	48.6079 (79)							
Southwest		2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)							
Solar gains	79.3077	135.0903	184.8364	229.0213	256.5230	254.6679	245.5271	225.0096	200.1388	149.3036	94.9923	67.8708	67.8708	(83)
Total gains	548.5421	600.0945	631.3896	647.4133	646.4626	619.2256	595.4237	582.5956	574.1139	551.6286	528.5742	524.7331	524.7331	(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	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	
alpha	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	
util living area	0.9834	0.9717	0.9477	0.8936	0.7841	0.6103	0.4475	0.4769	0.6909	0.8965	0.9693	0.9867	0.9867	(86)
MIT	20.2101	20.3423	20.5283	20.7368	20.9003	20.9793	20.9967	20.9953	20.9599	20.7693	20.4468	20.1643	20.1643	(87)
Th 2	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	(88)
util rest of house	0.9790	0.9642	0.9339	0.8657	0.7322	0.5325	0.3575	0.3858	0.6159	0.8639	0.9598	0.9831	0.9831	(89)
MIT 2	19.0674	19.2562	19.5183	19.8012	20.0031	20.0836	20.0961	20.0954	20.0677	19.8490	19.4080	19.0017	19.0017	(90)
Living area fraction													fLA = Living area / (4) = 0.3896 (91)	
MIT	19.5126	19.6793	19.9118	20.1657	20.3527	20.4326	20.4470	20.4460	20.4153	20.2076	19.8128	19.4547	19.4547	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.5126	19.6793	19.9118	20.1657	20.3527	20.4326	20.4470	20.4460	20.4153	20.2076	19.8128	19.4547	19.4547	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9753	0.9600	0.9306	0.8680	0.7477	0.5621	0.3927	0.4214	0.6434	0.8684	0.9562	0.9798	0.9798	(94)
Useful gains	535.0083	576.1165	587.5630	561.9602	483.3766	348.0725	233.7959	245.4935	369.4115	479.0079	505.4090	514.1294	514.1294	(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	4.2000	(96)
Heat loss rate W	928.2092	901.7721	818.3322	687.3858	527.9486	355.8788	234.7267	246.8715	385.3325	586.2136	775.6779	930.7744	930.7744	(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	1.0000	(97a)
Space heating kWh	292.5415	218.8406	171.6923	90.3064	33.1615	0.0000	0.0000	0.0000	0.0000	79.7610	194.5936	309.9839	309.9839	(98)
Space heating													1390.8808 (98)	
Space heating per m2													(98) / (4) = 22.4119 (99)	

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1487.5730 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	292.5415	218.8406	171.6923	90.3064	33.1615	0.0000	0.0000	0.0000	0.0000	79.7610	194.5936	309.9839	(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)	312.8786	234.0541	183.6281	96.5844	35.4669	0.0000	0.0000	0.0000	0.0000	85.3059	208.1215	331.5336	(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	89.3950	89.2771	89.0591	88.6487	87.9930	87.3000	87.3000	87.3000	87.3000	88.5246	89.1684	87.3000	(216)
Fuel for water heating, kWh/month	166.5031	146.2474	152.3225	134.8923	131.5043	116.0228	109.1391	122.9226	123.7028	140.1931	150.0270	161.6228	(219)
Water heating fuel used													1655.0997 (219)
Annual totals kWh/year													
Space heating fuel - main system													1487.5730 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3582.0119 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1487.5730	3.4800	51.7675 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1655.0997	3.4800	57.5975 (247)
Mechanical ventilation fans	43.7996	13.1900	5.7772 (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			287.3139 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1271 (257)
SAP value		84.2764
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	1487.5730	0.2160	321.3158 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1655.0997	0.2160	357.5015 (264)
Space and water heating			678.8173 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			906.8344 (272)
CO2 emissions per m2			14.6100 (273)
EI value			88.6497
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	$3.48 / 0.8839 = 3.937$ , stars = 4
Water heating environmental impact	$0.216 / 0.8839 = 0.2444$ , 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 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.7833		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.5423 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157	61.0157 (39)
Average = Sum(39)m / 12 =												61.0157 (39)
HLP	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832	0.9832 (40)
HLP (average)												0.9832 (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
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)
	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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Energy content (annual)													Total = Sum(45)m =	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	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	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	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	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	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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (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	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	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	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	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	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	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	-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	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	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				
Southwest			3.9900	40.9830		0.4300		0.0000		0.7700		54.1422 (79)		
Southwest			2.5200	40.9830		0.4300		0.0000		0.7700		34.1951 (79)		
Solar gains	88.3373	140.1560	188.5335	246.0339	266.7142	276.3674	263.6445	242.8615	216.5330	161.8569	108.3758	74.8847	74.8847	(83)
Total gains	557.5718	605.1602	635.0866	664.4260	656.6538	640.9250	613.5411	600.4475	590.5081	564.1819	541.9577	531.7469	531.7469	(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	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	66.0791	
alpha	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	5.4053	
util living area	0.9803	0.9684	0.9392	0.8659	0.7303	0.5247	0.3375	0.3448	0.6013	0.8593	0.9595	0.9839	0.9839	(86)
MIT	20.2620	20.3772	20.5754	20.7919	20.9356	20.9911	20.9994	20.9993	20.9819	20.8337	20.5198	20.2235	20.2235	(87)
Th 2	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	20.0974	(88)
util rest of house	0.9749	0.9600	0.9231	0.8322	0.6705	0.4440	0.2483	0.2537	0.5188	0.8169	0.9470	0.9794	0.9794	(89)
MIT 2	19.1421	19.3059	19.5836	19.8713	20.0413	20.0924	20.0972	20.0972	20.0861	19.9290	19.5106	19.0872	19.0872	(90)
Living area fraction													fLA = Living area / (4) =	
MIT	19.5785	19.7233	19.9701	20.2300	20.3897	20.4426	20.4487	20.4487	20.4351	20.2815	19.9038	19.5300	19.5300	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.5785	19.7233	19.9701	20.2300	20.3897	20.4426	20.4487	20.4487	20.4351	20.2815	19.9038	19.5300	19.5300	(93)

#### 8. Space heating requirement

Utilisation	0.9710	0.9558	0.9204	0.8376	0.6908	0.4753	0.2831	0.2892	0.5504	0.8264	0.9438	0.9759	0.9759	(94)
Useful gains	541.4299	578.4163	584.5540	556.5162	453.6030	304.6180	173.6802	173.6623	325.0347	466.2372	511.4880	518.9331	518.9331	(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	4.7000	(96)
Heat loss rate W	907.8202	886.1508	791.3774	654.6995	481.3981	307.6749	173.8166	173.8142	331.6266	541.9105	744.6219	904.8608	904.8608	(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	1.0000	(97a)
Space heating kWh	272.5944	206.7975	153.8766	70.6920	20.6796	0.0000	0.0000	0.0000	0.0000	56.3009	167.8564	287.1302	287.1302	(98)
Space heating per m <sup>2</sup>													(98) / (4) = 19.9150 (99)	

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1321.8476 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	272.5944	206.7975	153.8766	70.6920	20.6796	0.0000	0.0000	0.0000	0.0000	56.3009	167.8564	287.1302	(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)	291.5448	221.1738	164.5739	75.6064	22.1172	0.0000	0.0000	0.0000	0.0000	60.2149	179.5256	307.0911	(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	89.3434	89.2341	88.9720	88.4621	87.7705	87.3000	87.3000	87.3000	87.3000	88.2741	89.0523	87.3000	(216)
Fuel for water heating, kWh/month	166.5994	146.3180	152.4717	135.1767	131.8376	116.0228	109.1391	122.9226	123.7028	140.5910	150.2227	161.7214	(219)
Water heating fuel used													1656.7257 (219)
Annual totals kWh/year													
Space heating fuel - main system													1321.8476 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3417.9125 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1321.8476	3.9200	51.8164 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1656.7257	3.9200	64.9436 (247)
Mechanical ventilation fans	43.7996	16.9600	7.4284 (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			279.2720 (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	1321.8476	0.2160	285.5191 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.7257	0.2160	357.8527 (264)
Space and water heating			643.3718 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			871.3889 (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	1321.8476	1.2200	1612.6541 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.7257	1.2200	2021.2053 (264)
Space and water heating			3633.8594 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	320.5396	3.0700	984.0566 (268)
Primary energy kWh/year			4982.6308 (272)
Primary energy kWh/m2/year			80.2873 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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:	SAP change	Cost change	CO2 change
(none)			

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	£75	£75	£0
Mains gas	£205	£205	£0
Space heating	£160	£160	£0
Water heating	£65	£65	£0
Lighting	£54	£54	£0
Total cost of fuels	£280	£280	£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	80 kWh/m <sup>2</sup>	80 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	South East
Overshading	Average or unknown
Thermal mass parameter	233.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.00 (Windows half open)

#### Overheating Calculation

Summer ventilation heat loss coefficient	97.89 (P1)
Transmission heat loss coefficient	36.54 (37)
Summer heat loss coefficient	134.44 (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	3.9900	122.3147	0.4300	0.0000	0.9000	188.8698
South West	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862
total:						308.1559

	Jun	Jul	Aug	
Solar gains	323	308	284	(P4)
Internal gains	362	347	355	
Total summer gains	685	655	638	(P5)
Summer gain/loss ratio	5.09	4.87	4.75	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 233.9)	0.36	0.36	0.36	
Threshold temperature	20.86	22.84	22.71	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			