

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-001			<b>Issued on Date</b>	12/02/2020
<b>Assessment Reference</b>	001	<b>Prop Type Ref</b>	GFF Semi		
<b>Property</b>	Plot 001, 1 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	83 B	<b>DER</b>	19.61	<b>TER</b>	21.71
<b>Environmental</b>	88 B	<b>% DER&lt;TER</b>	9.66		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.78	<b>DFEE</b>	47.16	<b>TFEE</b>	54.91
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	14.12		
<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

Ground-floor flat, total floor area 47 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) 21.71 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 19.61 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.9 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 47.2 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (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	1.35 (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 North East: 3.99 m<sup>2</sup>, No overhang

Windows facing North West: 2.52 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9792		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss						(33) + (36) =	32.5291 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =												51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)

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

Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m =											1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)
											Total per year (kWh/year) = Sum(64)m =	1299.8227 (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	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.3405	11.8489	9.6361	7.2952	5.4532	4.6039	4.9746	6.4662	8.6789	11.0199	12.8618	13.7112 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	259.8796	258.1600	248.8366	234.0292	219.3417	204.9868	195.5526	200.2940	207.8165	222.7887	239.9257	252.4447 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)						
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609 (83)
Total gains	284.1995	307.6639	338.0269	380.5054	416.2345	414.8953	391.9177	356.8385	316.4963	283.2864	270.5265	272.3056 (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	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589
alpha	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839
util living area	0.9975	0.9957	0.9898	0.9654	0.8852	0.7224	0.5580	0.6288	0.8768	0.9804	0.9954	0.9980 (86)
MIT	19.8099	19.9219	20.1518	20.4767	20.7780	20.9438	20.9878	20.9783	20.8439	20.4706	20.0792	19.7747 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9967	0.9944	0.9862	0.9525	0.8433	0.6348	0.4401	0.5075	0.8149	0.9708	0.9936	0.9973 (89)
MIT 2	18.4218	18.5851	18.9195	19.3839	19.7869	19.9718	20.0060	20.0012	19.8768	19.3819	18.8154	18.3704 (90)
Living area fraction	19.0131	19.1545	19.4444	19.8493	20.2090	20.3858	20.4242	20.4174	20.2887	19.8456	19.3537	0.4259 (91)
Temperature adjustment	19.0131	19.1545	19.4444	19.8493	20.2090	20.3858	20.4242	20.4174	20.2887	19.8456	19.3537	18.9685 (92)
adjusted MIT	19.0131	19.1545	19.4444	19.8493	20.2090	20.3858	20.4242	20.4174	20.2887	19.8456	19.3537	18.9685 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9955	0.9927	0.9835	0.9499	0.8528	0.6700	0.4906	0.5594	0.8347	0.9687	0.9919	0.9964 (94)	
Ext temp.	282.9308	305.4158	332.4561	361.4485	354.9506	277.9601	192.2702	199.6025	264.1823	274.4239	268.3445	271.3201 (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	750.7783	727.3785	660.5249	558.7237	434.1983	295.2395	195.1393	204.9977	315.7985	471.7853	625.2816	753.6094 (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	348.0785	283.5589	244.0832	142.0381	58.9602	0.0000	0.0000	0.0000	0.0000	146.8369	256.9947	358.8233 (98)	
Space heating per m2												1839.3739 (98)	
												(98) / (4) =	39.2107 (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

	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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1967.2448 (211)
Space heating requirement	348.0785	283.5589	244.0832	142.0381	58.9602	0.0000	0.0000	0.0000	0.0000	146.8369	256.9947	358.8233	(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)	372.2765	303.2715	261.0516	151.9124	63.0591	0.0000	0.0000	0.0000	0.0000	157.0448	274.8607	383.7682	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.5982	89.5493	89.4183	89.1032	88.4397	87.3000	87.3000	87.3000	87.3000	89.1002	89.4649	89.6360	(216)
Fuel for water heating, kWh/month	147.0405	129.1045	134.4566	119.1107	116.2511	103.2711	97.3228	109.3613	109.9774	123.6127	132.4869	142.8251	(219)
Water heating fuel used													1464.8207 (219)
Annual totals kWh/year													
Space heating fuel - main system													1967.2448 (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)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													235.5965 (232)
Total delivered energy for all uses													3775.7694 (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	1967.2448	0.2160	424.9249	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1464.8207	0.2160	316.4013	(264)
Space and water heating			741.3262	(265)
Pumps and fans	108.1073	0.5190	56.1077	(267)
Energy for lighting	235.5965	0.5190	122.2746	(268)
Total CO2, kg/year			919.7084	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.6100	(273)

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

DER			19.6100 ZC1
Total Floor Area		TFA	46.9100
Assumed number of occupants		N	1.5997
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			17.5861 ZC2
CO2 emissions from cooking, equation (L16)			3.3552 ZC3
Total CO2 emissions			40.5513 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			40.5513 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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4284 (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) =	0.3641 (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	0.4643	0.4552	0.4461	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4279 (22b)
Effective ac	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (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			46.9100	0.1300	6.0983		(28a)					
External Wall	34.9900	8.6300	26.3600	0.1800	4.7448		(29a)					
External Wall to Corridor	3.6000		3.6000	0.1800	0.6480		(29a)					
External Wall to Stairwell	11.9300		11.9300	0.1800	2.1474		(29a)					
Total net area of external elements Aum(A, m2)			97.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.3892	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1336 (36)					
Total fabric heat loss						(33) + (36) =	31.5228 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	22.4863	22.3314	22.1797	21.4668	21.3335	20.7126	20.7126	20.5976	20.9517	21.3335	21.6033	21.8853 (38)
Heat transfer coeff	54.0091	53.8542	53.7025	52.9896	52.8562	52.2354	52.2354	52.1204	52.4745	52.8562	53.1261	53.4081 (39)
Average = Sum(39)m / 12 =												52.9890 (39)
HLP	1.1513	1.1480	1.1448	1.1296	1.1268	1.1135	1.1135	1.1111	1.1186	1.1268	1.1325	1.1385 (40)
HLP (average)												1.1296 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)												1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (46)
Total storage loss:												
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 (56)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
	40.4671	35.2218	37.5241	34.8896	34.5810	32.0414	33.1095	34.5810	34.8896	37.5241	37.7377	40.4671	40.4671	40.4671	(61)
Total heat required for water heating calculated for each month															
Solar input	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	154.5159	154.5159	(62)
	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															
	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	154.5159	154.5159	(64)
Heat gains from water heating, kWh/month															
	49.2735	43.0522	44.7206	39.5323	38.2081	33.5208	31.9166	35.7716	36.1727	41.3717	44.3548	48.0380	48.0380	48.0380	(65)

#### 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	(66)
	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.3405	11.8489	9.6361	7.2952	5.4532	4.6039	4.9746	6.4662	8.6789	11.0199	12.8618	13.7112	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	(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)													
	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	(71)
Water heating gains (Table 5)													
	66.2279	64.0658	60.1083	54.9060	51.3550	46.5567	42.8986	48.0801	50.2399	55.6071	61.6038	64.5672	(72)
Total internal gains													
	268.7795	266.5704	256.7599	241.4665	226.2905	211.4483	202.0184	207.2468	215.2597	230.7180	248.3396	261.3470	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	3.9900	11.2829	0.6300	0.7000	0.7700	13.7584 (75)							
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)							
Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321	(83)
Total gains	291.2274	312.2637	339.0846	376.6674	408.0271	405.1987	383.2679	351.7410	315.5737	286.5588	276.5848	279.6791	(84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)													
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	(85)
alpha	60.3165	60.4899	60.6609	61.4769	61.6321	62.3646	62.3646	62.5022	62.0804	61.6321	61.3190	60.9952	
util living area	5.0211	5.0327	5.0441	5.0985	5.1088	5.1576	5.1576	5.1668	5.1387	5.1088	5.0879	5.0663	
	0.9977	0.9962	0.9914	0.9715	0.9034	0.7479	0.5817	0.6486	0.8888	0.9825	0.9958	0.9981	(86)
MIT	19.7762	19.8865	20.1132	20.4469	20.7528	20.9370	20.9861	20.9766	20.8357	20.4609	20.0700	19.7599	(87)
Th 2	19.9591	19.9618	19.9644	19.9767	19.9790	19.9898	19.9898	19.9918	19.9857	19.9790	19.9744	19.9695	(88)
util rest of house													
	0.9969	0.9949	0.9882	0.9600	0.8641	0.6585	0.4573	0.5225	0.8279	0.9734	0.9940	0.9975	(89)
MIT 2	18.3309	18.4938	18.8257	19.3135	19.7287	19.9464	19.9845	19.9817	19.8454	19.3406	18.7711	18.3144	(90)
Living area fraction													
	fLA = Living area / (4) = 0.4259 (91)												
MIT	18.9465	19.0870	19.3741	19.7962	20.1649	20.3683	20.4111	20.4054	20.2672	19.8177	19.3244	18.9301	(92)
Temperature adjustment													
adjusted MIT	18.9465	19.0870	19.3741	19.7962	20.1649	20.3683	20.4111	20.4054	20.2672	19.8177	19.3244	18.9301	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9958	0.9934	0.9858	0.9575	0.8723	0.6943	0.5108	0.5765	0.8475	0.9715	0.9925	0.9966	(94)
Useful gains	290.0058	310.2095	334.2680	360.6491	355.9176	281.3220	195.7548	202.7953	267.4333	278.3997	274.5094	278.7216	(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													
	791.0437	764.0294	691.3694	577.3866	447.4217	301.3109	199.0759	208.7632	323.6198	487.2155	649.4318	786.7077	(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													
	372.7722	304.9670	265.6835	156.0510	68.0791	0.0000	0.0000	0.0000	0.0000	155.3589	269.9442	377.9417	(98)
Space heating													
	1970.7975 (98)												
Space heating per m2													
	(98) / (4) = 42.0123 (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													2110.0616 (211)
Space heating requirement	372.7722	304.9670	265.6835	156.0510	68.0791	0.0000	0.0000	0.0000	0.0000	155.3589	269.9442	377.9417	(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)	399.1137	326.5171	284.4577	167.0782	72.8898	0.0000	0.0000	0.0000	0.0000	166.3372	289.0194	404.6485	(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	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	(64)
Efficiency of water heater (217)m	87.1342	86.9877	86.5758	85.5599	83.6201	80.3000	80.3000	80.3000	80.3000	85.4293	86.6308	87.2166	(217)
Fuel for water heating, kWh/month	181.5956	158.8955	166.1071	149.0778	147.6820	135.4479	129.7694	144.6625	146.2601	156.5467	164.7927	177.1635	(219)
Water heating fuel used													1858.0008 (219)
Annual totals kWh/year													
Space heating fuel - main system													2110.0616 (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)													235.5965 (232)
Total delivered energy for all uses													4278.6590 (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	2110.0616	0.2160	455.7733 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1858.0008	0.2160	401.3282 (264)
Space and water heating			857.1015 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	235.5965	0.5190	122.2746 (268)
Total CO2, kg/m2/year			1018.3011 (272)
Emissions per m2 for space and water heating			18.2712 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6066 (272b)
Emissions per m2 for pumps and fans			0.8298 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.2712 * 1.00) + 2.6066 + 0.8298, rounded to 2 d.p.			21.7100 (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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3784	(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) =	0.3216 (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	0.4101	0.4020	0.3940	0.3538	0.3458	0.3055	0.3055	0.2975	0.3216	0.3458	0.3618	0.3779 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9792		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			30.0000	1407.3000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9376.9220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							199.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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	21.6098	21.4890	21.3706	20.8145	20.7104	20.2260	20.2260	20.1363	20.4126	20.7104	20.9209	21.1410 (38)
Heat transfer coeff	54.1389	54.0181	53.8997	53.3435	53.2395	52.7551	52.7551	52.6654	52.9417	53.2395	53.4500	53.6701 (39)
Average = Sum(39)m / 12 =												53.3430 (39)
HLP	1.1541	1.1515	1.1490	1.1371	1.1349	1.1246	1.1246	1.1227	1.1286	1.1349	1.1394	1.1441 (40)
HLP (average)												1.1371 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)												Total = Sum(45)m = 1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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)
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	25.0250	21.8870	22.5854	19.6905	18.8935	16.3037	15.1078	17.3364	17.5434	20.4452	22.3175	24.2354		(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	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.3405	11.8489	9.6361	7.2952	5.4532	4.6039	4.9746	6.4662	8.6789	11.0199	12.8618	13.7112	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	(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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	(71)
Water heating gains (Table 5)	33.6357	32.5700	30.3568	27.3480	25.3945	22.6440	20.3061	23.3016	24.3659	27.4801	30.9965	32.5744	(72)
Total internal gains	233.1874	232.0746	224.0083	210.9085	197.3301	184.5356	176.4259	179.4683	186.3857	199.5909	214.7323	226.3542	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)							
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)							
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609	(83)
Total gains	257.5073	281.5786	313.1987	357.3847	394.2229	394.4441	372.7910	336.0128	295.0656	260.0886	245.3331	246.2151	(84)

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

Utilisation during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	48.1114	48.2190	48.3250	48.8288	48.9242	49.3734	49.3734	49.4575	49.1994	48.9242	48.7315	48.5317	21.0000 (85)
tau	4.2074	4.2146	4.2217	4.2553	4.2616	4.2916	4.2916	4.2972	4.2800	4.2616	4.2488	4.2354	
alpha	0.9964	0.9942	0.9873	0.9622	0.8895	0.7432	0.5892	0.6611	0.8860	0.9784	0.9939	0.9970	(86)
util living area	19.4609	19.5974	19.8761	20.2806	20.6552	20.8936	20.9701	20.9518	20.7517	20.2858	19.8099	19.4370	(87)
MIT	19.9569	19.9590	19.9610	19.9706	19.9724	19.9808	19.9808	19.9823	19.9776	19.9724	19.9688	19.9650	(88)
Th 2	0.9954	0.9925	0.9834	0.9498	0.8519	0.6600	0.4677	0.5399	0.8315	0.9692	0.9919	0.9962	(89)
util rest of house	18.5514	18.6890	18.9675	19.3716	19.7228	19.9245	19.9712	19.9650	19.8202	19.3831	18.9089	18.5338	(90)
Living area fraction	18.9387	19.0759	19.3545	19.7588	20.1200	20.3373	20.3967	20.3853	20.2170	19.7676	19.2927	18.9185	(91)
MIT	18.9387	19.0759	19.3545	19.7588	20.1200	20.3373	20.3967	20.3853	20.2170	19.7676	19.2927	18.9185	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9387	19.0759	19.3545	19.7588	20.1200	20.3373	20.3967	20.3853	20.2170	19.7676	19.2927	18.9185	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9906	0.9805	0.9467	0.8581	0.6913	0.5193	0.5908	0.8463	0.9668	0.9901	0.9951	(94)
Useful gains	255.9683	278.9382	307.0923	338.3444	338.2757	272.6870	193.5998	198.5181	249.7138	251.4652	242.9093	244.9968	(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	792.5248	765.7571	692.8519	579.2443	448.2746	302.6707	200.2934	209.8864	323.8432	488.0781	651.6975	789.9409	(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	399.1980	327.1423	287.0051	173.4479	81.8392	0.0000	0.0000	0.0000	0.0000	176.0400	294.3275	405.4384	(98)
Space heating												2144.4384	(98)
Space heating per m2												45.7139	(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	495.8980	390.3878	400.2570	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8314	0.8939	0.8585	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	412.3108	348.9510	343.6116	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	522.3082	495.8993	453.9240	0.0000	0.0000	0.0000	0.0000	(103)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	79.1982	109.3295	82.0724	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												270.6001 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												67.6500 (107)
Energy for space heating												1.4421 (108)
Energy for space cooling												45.7139 (99)
Total												1.4421 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.1560 (109)
												47.2 (109)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4284 (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) =	0.3641 (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	0.4643	0.4552	0.4461	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4279 (22b)
	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (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			46.9100	0.1300	6.0983		(28a)					
External Wall	34.9900	8.6300	26.3600	0.1800	4.7448		(29a)					
External Wall to Corridor	3.6000		3.6000	0.1800	0.6480		(29a)					
External Wall to Stairwell	11.9300		11.9300	0.1800	2.1474		(29a)					
Total net area of external elements Aum(A, m2)			97.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.3892	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1336 (36)					
Total fabric heat loss							(33) + (36) =					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Heat transfer coeff	22.4863	22.3314	22.1797	21.4668	21.3335	20.7126	20.7126	20.5976	20.9517	21.3335	21.6033	21.8853 (38)
Average = Sum(39)m / 12 =	54.0091	53.8542	53.7025	52.9896	52.8562	52.2354	52.2354	52.1204	52.4745	52.8562	53.1261	53.4081 (39)
												52.9890 (39)
HLP	1.1513	1.1480	1.1448	1.1296	1.1268	1.1135	1.1135	1.1111	1.1186	1.1268	1.1325	1.1385 (40)
HLP (average)												1.1296 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)												1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss												
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 (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	15.6794	23.3504	17.0962	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												56.1260 (107)
Space cooling per m2												1.1965 (108)
Energy for space heating												46.5513 (99)
Energy for space cooling												1.1965 (108)
Total												47.7478 (109)
Target Fabric Energy Efficiency (TFEE)												54.9 (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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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:												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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9792	(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Average = Sum(39)m / 12 =	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
RHI water heating demand												1300 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (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	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.3511	29.6222	24.0904	18.2380	13.6331	11.5096	12.4366	16.1655	21.6973	27.5497	32.1546	34.2781 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7853	209.9415	204.5080	192.9408	178.3393	164.6160	155.4479	153.2918	158.7252	170.2924	184.8939	198.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	379.6554	376.4100	361.9744	339.8385	317.5696	297.4119	285.5084	291.7756	304.4102	326.7110	351.4295	369.7513 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Northwest	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)						
Solar gains	27.9058	53.1289	94.2596	162.3155	209.7719	232.5890	215.6355	173.8280	121.6967	67.9281	36.0152	22.5400 (83)
Total gains	407.5612	429.5388	456.2341	502.1539	527.3414	530.0008	501.1439	465.6036	426.1069	394.6391	387.4447	392.2913 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9863	0.9806	0.9604	0.8933	0.7448	0.5282	0.3452	0.3711	0.6750	0.9115	0.9743	0.9883 (86)
MIT	20.1006	20.1942	20.4220	20.7107	20.9142	20.9878	20.9989	20.9985	20.9612	20.7276	20.3697	20.0707 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9822	0.9748	0.9483	0.8619	0.6810	0.4399	0.2453	0.2640	0.5813	0.8770	0.9653	0.9848 (89)
MIT 2	18.8431	18.9777	19.3019	19.6934	19.9368	20.0043	20.0106	20.0105	19.9864	19.7249	19.2317	18.8003 (90)
Living area fraction	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259	0.4259 (91)
MIT	19.3787	19.4959	19.7790	20.1267	20.3531	20.4232	20.4315	20.4313	20.4016	20.1520	19.7164	19.3414 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	19.3787	19.4959	19.7790	20.1267	20.3531	20.4232	20.4315	20.4313	20.4016	20.1520	19.7164	19.3414 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	398.9277	417.0847	431.0753	434.8587	371.3830	252.9891	144.3035	144.2160	264.1961	348.3423	372.7198	385.1042 (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	749.0245	729.4894	652.0873	542.2604	400.7297	256.3241	144.4881	144.4761	275.6318	446.5968	613.1755	747.1214 (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	260.4720	209.9360	164.4329	77.3292	21.8339	0.0000	0.0000	0.0000	0.0000	73.1014	173.1281	269.3408 (98)
Space heating RHI space heating demand												1249.5743 (98)
												1250 (98)



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



CALCULATION OF HEAT DEMAND 09 Jan 2014

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# 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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9792	(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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
(38)m	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =												51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m = 1135.8629 (45)											
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)
Total per year (kWh/year) = Sum(64)m = 1299.8227 (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	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.3511	29.6222	24.0904	18.2380	13.6331	11.5096	12.4366	16.1655	21.6973	27.5497	32.1546	34.2781 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7853	209.9415	204.5080	192.9408	178.3393	164.6160	155.4479	153.2918	158.7252	170.2924	184.8939	198.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	379.6554	376.4100	361.9744	339.8385	317.5696	297.4119	285.5084	291.7756	304.4102	326.7110	351.4295	369.7513 (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							
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)						
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609 (83)
Total gains	403.9754	425.9139	451.1648	486.3146	514.4623	507.3204	481.8735	448.3201	413.0900	387.2088	382.0303	389.6122 (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	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589
alpha	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839
util living area	0.9880	0.9826	0.9668	0.9176	0.8002	0.6175	0.4608	0.5141	0.7625	0.9362	0.9797	0.9900 (86)
MIT	20.0520	20.1566	20.3644	20.6418	20.8683	20.9722	20.9948	20.9911	20.9223	20.6480	20.2989	20.0132 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9845	0.9775	0.9567	0.8926	0.7459	0.5327	0.3599	0.4083	0.6834	0.9112	0.9727	0.9871 (89)
MIT 2	18.7727	18.9235	19.2207	19.6035	19.8871	19.9929	20.0089	20.0072	19.9517	19.6204	19.1305	18.7167 (90)
Living area fraction	19.3176	19.4487	19.7078	20.0457	20.3050	20.4100	20.4288	20.4263	20.3651	20.0581	19.6282	0.4259 (91)
Temperature adjustment	19.3176	19.4487	19.7078	20.0457	20.3050	20.4100	20.4288	20.4263	20.3651	20.0581	19.6282	19.2689 (92)
adjusted MIT	19.3176	19.4487	19.7078	20.0457	20.3050	20.4100	20.4288	20.4263	20.3651	20.0581	19.6282	0.0000 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9814	0.9738	0.9529	0.8936	0.7632	0.5679	0.4030	0.4535	0.7137	0.9126	0.9693	0.9842 (94)
Ext temp.	396.4525	414.7643	429.9324	434.5507	392.6160	288.1260	194.1916	203.3266	294.8264	353.3687	370.2981	383.4508 (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	766.3170	742.3919	673.9686	568.7438	439.0985	296.4715	195.3764	205.4521	319.6954	482.6268	639.2873	768.9377 (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	275.1792	220.1658	181.5629	96.6190	34.5829	0.0000	0.0000	0.0000	0.0000	96.1680	193.6722	286.8023 (98)
Total per year (kWh/year) = Sum(98)m = 1384.7523 (98)												
Space heating per m2											(98) / (4) = 29.5193 (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

	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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1481.0185 (211)
Space heating requirement	275.1792	220.1658	181.5629	96.6190	34.5829	0.0000	0.0000	0.0000	0.0000	96.1680	193.6722	286.8023	(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)	294.3093	235.4714	194.1850	103.3358	36.9871	0.0000	0.0000	0.0000	0.0000	102.8535	207.1361	306.7404	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.4386	89.3721	89.1975	88.7962	88.0840	87.3000	87.3000	87.3000	87.3000	88.7630	89.2579	89.4877	(216)
Fuel for water heating, kWh/month	147.3030	129.3606	134.7895	119.5225	116.7206	103.2711	97.3228	109.3613	109.9774	124.0823	132.7942	143.0619	(219)
Water heating fuel used													1467.5672 (219)
Annual totals kWh/year													
Space heating fuel - main system													1481.0185 (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)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													235.5965 (232)
Total delivered energy for all uses													3292.2896 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1481.0185	3.4800	51.5394	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1467.5672	3.4800	51.0713	(247)
Mechanical ventilation fans	33.1073	13.1900	4.3669	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	235.5965	13.1900	31.0752	(250)
Additional standing charges			120.0000	(251)
Total energy cost			267.9453	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2244	(257)
SAP value		82.9193	
SAP rating (Section 12)		83	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1481.0185	0.2160	319.9000	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1467.5672	0.2160	316.9945	(264)
Space and water heating			636.8945	(265)
Pumps and fans	108.1073	0.5190	56.1077	(267)
Energy for lighting	235.5965	0.5190	122.2746	(268)
Total kg/year			815.2768	(272)
CO2 emissions per m2			17.3800	(273)
EI value			88.1137	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$ , stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$ , stars = 4
Water heating energy efficiency	$3.48 / 0.8847 = 3.934$ , stars = 4
Water heating environmental impact	$0.216 / 0.8847 = 0.2442$ , 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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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:												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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9792	(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss						(33) + (36) =	32.5291 (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
(38)m	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =												51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m =											1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)
											Total per year (kWh/year) = Sum(64)m =	1299.8227 (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	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.3511	29.6222	24.0904	18.2380	13.6331	11.5096	12.4366	16.1655	21.6973	27.5497	32.1546	34.2781 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7853	209.9415	204.5080	192.9408	178.3393	164.6160	155.4479	153.2918	158.7252	170.2924	184.8939	198.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	379.6554	376.4100	361.9744	339.8385	317.5696	297.4119	285.5084	291.7756	304.4102	326.7110	351.4295	369.7513 (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					
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Northwest	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)						
Solar gains	27.9058	53.1289	94.2596	162.3155	209.7719	232.5890	215.6355	173.8280	121.6967	67.9281	36.0152	22.5400 (83)
Total gains	407.5612	429.5388	456.2341	502.1539	527.3414	530.0008	501.1439	465.6036	426.1069	394.6391	387.4447	392.2913 (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	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589
alpha	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839
util living area	0.9863	0.9806	0.9604	0.8933	0.7448	0.5282	0.3452	0.3711	0.6750	0.9115	0.9743	0.9883 (86)
MIT	20.1006	20.1942	20.4220	20.7107	20.9142	20.9878	20.9989	20.9985	20.9612	20.7276	20.3697	20.0707 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9822	0.9748	0.9483	0.8619	0.6810	0.4399	0.2453	0.2640	0.5813	0.8770	0.9653	0.9848 (89)
MIT 2	18.8431	18.9777	19.3019	19.6934	19.9368	20.0043	20.0106	20.0105	19.9864	19.7249	19.2317	18.8003 (90)
Living area fraction	19.3787	19.4959	19.7790	20.1267	20.3531	20.4232	20.4315	20.4313	20.4016	20.1520	19.7164	0.4259 (91)
Temperature adjustment	19.3787	19.4959	19.7790	20.1267	20.3531	20.4232	20.4315	20.4313	20.4016	20.1520	19.7164	0.0000
adjusted MIT	19.3787	19.4959	19.7790	20.1267	20.3531	20.4232	20.4315	20.4313	20.4016	20.1520	19.7164	19.3414 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9788	0.9710	0.9449	0.8660	0.7043	0.4773	0.2879	0.3097	0.6200	0.8827	0.9620	0.9817 (94)
Ext temp.	398.9277	417.0847	431.0753	434.8587	371.3830	252.9891	144.3035	144.2160	264.1961	348.3423	372.7198	385.1042 (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	749.0245	729.4894	652.0873	542.2604	400.7297	256.3241	144.4881	144.4761	275.6318	446.5968	613.1755	747.1214 (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	260.4720	209.9360	164.4329	77.3292	21.8339	0.0000	0.0000	0.0000	0.0000	73.1014	173.1281	269.3408 (98)
											(98) / (4) =	26.6377 (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

	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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1336.4431 (211)
Space heating requirement	260.4720	209.9360	164.4329	77.3292	21.8339	0.0000	0.0000	0.0000	0.0000	73.1014	173.1281	269.3408	(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)	278.5797	224.5305	175.8640	82.7051	23.3518	0.0000	0.0000	0.0000	0.0000	78.1833	185.1637	288.0650	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.3993	89.3371	89.1203	88.6208	87.8441	87.3000	87.3000	87.3000	87.3000	88.5491	89.1716	89.4437	(217)
Fuel for water heating, kWh/month	147.3677	129.4112	134.9063	119.7591	117.0393	103.2711	97.3228	109.3613	109.9774	124.3821	132.9226	143.1322	(219)
Water heating fuel used													1468.8532 (219)
Annual totals kWh/year													
Space heating fuel - main system													1336.4431 (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)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													235.5965 (232)
Total delivered energy for all uses													3149.0001 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1336.4431	3.9200	52.3886	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1468.8532	3.9200	57.5790	(247)
Mechanical ventilation fans	33.1073	16.9600	5.6150	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	235.5965	16.9600	39.9572	(250)
Additional standing charges			88.0000	(251)
Total energy cost			256.2598	(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	1336.4431	0.2160	288.6717	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1468.8532	0.2160	317.2723	(264)
Space and water heating			605.9440	(265)
Pumps and fans	108.1073	0.5190	56.1077	(267)
Energy for lighting	235.5965	0.5190	122.2746	(268)
Total kg/year			784.3263	(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	1336.4431	1.2200	1630.4605	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1468.8532	1.2200	1792.0009	(264)
Space and water heating			3422.4614	(265)
Pumps and fans	108.1073	3.0700	331.8895	(267)
Energy for lighting	235.5965	3.0700	723.2813	(268)
Primary energy kWh/year			4477.6322	(272)
Primary energy kWh/m2/year			95.4516	(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 83  
 Current environmental impact rating: B 88

(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
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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 83  
 Potential environmental impact rating: B 88

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	£58	£58	£0
Mains gas	£198	£198	£0
Space heating	£159	£159	£0
Water heating	£58	£58	£0
Lighting	£40	£40	£0
Total cost of fuels	£256	£256	£0
Total cost of uses	£257	£257	£0
Delivered energy	67 kWh/m <sup>2</sup>	67 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>	17 kg/m <sup>2</sup>	17 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	95 kWh/m <sup>2</sup>	95 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	239.9 (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	74.00 (P1)
Transmission heat loss coefficient	32.53 (37)
Summer heat loss coefficient	106.52 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
North 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
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
North West	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644
total:						252.0415

	Jun	Jul	Aug
Solar gains	272	252	203 (P4)
Internal gains	294	283	289
Total summer gains	566	535	492 (P5)
Summer gain/loss ratio	5.32	5.02	4.62 (P6)
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 239.9)	0.32	0.32	0.32
Threshold temperature	21.04	22.94	22.54 (P7)
Likelihood of high internal temperature	Slight	Medium	Medium
Assessment of likelihood of high internal temperature:	Medium		