

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-002		<b>Issued on Date</b>	30/04/2020	
<b>Assessment Reference</b>	002	<b>Prop Type Ref</b>	GFF Semi		
<b>Property</b>	Plot 002, 1 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	83 B	<b>DER</b>	20.27	<b>TER</b>	20.93
<b>Environmental</b>	88 B	<b>% DER&lt;TER</b>	3.14		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.79	<b>DFEE</b>	48.91	<b>TFEE</b>	50.34
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	2.83		
<b>Assessor Details</b>	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			<b>Assessor ID</b>	4907-0015
<b>Client</b>	TW North Thames, Taylor Wimpey				

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Ground-floor flat, total floor area 46 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) 20.93 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 20.27 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.3 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 48.9 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	1.35 (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): Slight OK  
Based on:  
Overshading: Average  
Windows facing South West: 3.99 m<sup>2</sup>, No overhang  
Windows facing North West: 2.52 m<sup>2</sup>, Overhang twice as wide as window, ratio 0.72  
Air change rate: 2.00 ach  
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

#### 10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K  
Door U-value 1.08 W/m<sup>2</sup>K

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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:												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 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 (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10994.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							240.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss							(33) + (36) = 32.0162 (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	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Energy content (annual)													Total = Sum(45)m =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m														
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	(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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	(61)	
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)	
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	(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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	(72)
Total internal gains	255.3980	253.7060	244.5604	230.0374	215.6466	201.5626	192.2927	196.9727	204.3375	219.0235	235.8366	248.1051	(73)

#### 6. Solar gains

[Jan]		Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Southwest		3.9900	36.7938	0.2800		0.7000		0.7700	19.9406 (79)				
Northwest		2.5200	11.2829	0.2800		0.7000		0.7700	3.8620 (81)				
Solar gains	23.8026	41.8274	60.6374	80.8439	95.7648	97.3653	92.9163	81.4340	67.5798	47.1468	28.7436	20.2189	(83)
Total gains	279.2005	295.5333	305.1977	310.8813	311.4114	298.9279	285.2090	278.4067	271.9173	266.1703	264.5801	268.3240	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	
util living area	0.9974	0.9961	0.9928	0.9831	0.9527	0.8627	0.7122	0.7471	0.9173	0.9834	0.9954	0.9979	(86)
MIT	19.8070	19.9053	20.0952	20.3579	20.6387	20.8663	20.9634	20.9524	20.7947	20.4461	20.0746	19.7734	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9966	0.9948	0.9902	0.9761	0.9298	0.7909	0.5791	0.6209	0.8680	0.9751	0.9936	0.9972	(89)
MIT 2	18.4135	18.5570	18.8338	19.2143	19.6100	19.8985	19.9889	19.9816	19.8188	19.3433	18.8047	18.3644	(90)
Living area fraction													fLA = Living area / (4) = 0.4368 (91)
MIT	19.0222	19.1460	19.3848	19.7138	20.0594	20.3213	20.4146	20.4057	20.2451	19.8250	19.3594	18.9799	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0222	19.1460	19.3848	19.7138	20.0594	20.3213	20.4146	20.4057	20.2451	19.8250	19.3594	18.9799	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9954	0.9932	0.9880	0.9735	0.9313	0.8168	0.6377	0.6760	0.8821	0.9731	0.9919	0.9963	(94)
Useful gains	277.9290	293.5300	301.5314	302.6299	290.0206	244.1533	181.8825	188.1902	239.8550	259.0040	262.4484	267.3196	(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	736.9035	713.0643	644.9313	541.2730	418.4170	286.3704	190.9347	200.5000	307.5830	461.7474	613.6288	739.7883	(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	341.4770	281.9270	255.4895	171.8231	95.5269	0.0000	0.0000	0.0000	0.0000	150.8411	252.8499	351.5167	(98)
Space heating													1901.4512 (98)
Space heating per m <sup>2</sup>													(98) / (4) = 41.5709 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2033.6377 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	341.4770	281.9270	255.4895	171.8231	95.5269	0.0000	0.0000	0.0000	0.0000	150.8411	252.8499	351.5167	(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)	365.2161	301.5262	273.2508	183.7680	102.1678	0.0000	0.0000	0.0000	0.0000	161.3274	270.4277	375.9537	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.5923	89.5521	89.4578	89.2583	88.8202	87.3000	87.3000	87.3000	87.3000	89.1290	89.4605	87.3000	(216)
Fuel for water heating, kWh/month	145.5827	127.8165	133.0712	117.7452	114.6361	102.2906	96.4142	108.3185	108.9221	122.3679	131.1829	141.4151	(219)
Water heating fuel used												1449.7629	(219)
Annual totals kWh/year													
Space heating fuel - main system													2033.6377 (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)													32.2816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.2816 (231)
Electricity for lighting (calculated in Appendix L)													229.2145 (232)
Total delivered energy for all uses													3819.8967 (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	2033.6377	0.2160	439.2657 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1449.7629	0.2160	313.1488 (264)
Space and water heating			752.4145 (265)
Pumps and fans	107.2816	0.5190	55.6791 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total CO2, kg/year			927.0560 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.2700 (273)

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

	TFA	N	EF	
DER				20.2700 ZC1
Total Floor Area				45.7400
Assumed number of occupants				1.5659
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				17.6439 ZC2
CO2 emissions from cooking, equation (L16)				3.4233 ZC3
Total CO2 emissions				41.3372 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				41.3372 ZC8

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	109.3186 (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) =	0.1830 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4330 (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) =	0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (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			45.7400	0.1300	5.9462		(28a)
External Wall	38.8100	8.6300	30.1800	0.1800	5.4324		(29a)
External Wall to Corridor	10.0200		10.0200	0.1800	1.8036		(29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	23.9329	(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)							6.7523 (36)
Total fabric heat loss							(33) + (36) = 30.6852 (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	22.0087	21.8545	21.7033	20.9934	20.8606	20.2422	20.2422	20.1277	20.4804	20.8606	21.1293	21.4102 (38)
Average = Sum(39)m / 12 =	52.6939	52.5397	52.3885	51.6786	51.5458	50.9274	50.9274	50.8129	51.1656	51.5458	51.8145	52.0954 (39)
HLP	1.1520	1.1487	1.1454	1.1298	1.1269	1.1134	1.1134	1.1109	1.1186	1.1269	1.1328	1.1389 (40)
HLP (average)												1.1298 (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	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)												Total = Sum(45)m = 1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (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	40.0170	34.8301	37.1067	34.5015	34.1964	31.6850	32.7412	34.1964	34.5015	37.1067	37.3179	40.0170 (61)
Total heat required for water heating calculated for each month	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973 (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	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973 (64)
Heat gains from water heating, kWh/month	48.7255	42.5734	44.2232	39.0926	37.7831	33.1480	31.5616	35.3737	35.7704	40.9116	43.8614	47.5037 (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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	65.4913	63.3532	59.4398	54.2953	50.7838	46.0389	42.4215	47.5453	49.6811	54.9886	60.9186	63.8491 (72)
Total internal gains	264.1483	261.9723	252.3448	237.3412	222.4673	207.9012	198.6355	203.7973	211.6471	226.8138	244.1062	256.8578 (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	0.6300	0.7000	0.7700	44.8662 (79)						
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)						
Solar gains	53.5557	94.1115	136.4341	181.8987	215.4708	219.0719	209.0616	183.2266	152.0545	106.0804	64.6731	45.4924 (83)
Total gains	317.7040	356.0838	388.7788	419.2399	437.9381	426.9731	407.6971	387.0238	363.7016	332.8942	308.7792	302.3502 (84)

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

Temperature 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)	60.2800	60.4569	60.6314	61.4643	61.6227	62.3709	62.3709	62.5115	62.0806	61.6227	61.3031	60.9726
tau	5.0187	5.0305	5.0421	5.0976	5.1082	5.1581	5.1581	5.1674	5.1387	5.1082	5.0869	5.0648
util living area	0.9961	0.9925	0.9830	0.9530	0.8716	0.7080	0.5380	0.5855	0.8244	0.9648	0.9923	0.9970 (86)
MIT	19.8434	19.9886	20.2243	20.5347	20.7986	20.9511	20.9902	20.9852	20.8901	20.5569	20.1476	19.8195 (87)
Th 2	19.9586	19.9613	19.9640	19.9765	19.9789	19.9899	19.9899	19.9919	19.9857	19.9789	19.9741	19.9692 (88)
util rest of house	0.9949	0.9900	0.9771	0.9357	0.8253	0.6177	0.4205	0.4664	0.7493	0.9484	0.9892	0.9960 (89)
MIT 2	18.4283	18.6414	18.9843	19.4328	19.7816	19.9574	19.9863	19.9859	19.8991	19.4724	18.8832	18.4011 (90)
Living area fraction	19.0464	19.2299	19.5260	19.9141	20.2259	20.3915	20.4248	20.4224	fLA = Living area / (4) =	20.3320	19.9461	19.4355
MIT	19.0464	19.2299	19.5260	19.9141	20.2259	20.3915	20.4248	20.4224	20.3320	19.9461	19.4355	19.0207 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0464	19.2299	19.5260	19.9141	20.2259	20.3915	20.4248	20.4224	20.3320	19.9461	19.4355	19.0207 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	315.5840	351.6947	378.6349	391.7395	366.8801	279.8687	192.5113	200.7585	282.7818	315.5049	304.7889	300.7507 (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	777.0475	752.8870	682.4123	569.1933	439.4725	294.9440	194.7889	204.3896	318.8634	481.7534	639.1597	772.0905 (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	343.3288	269.6012	226.0103	127.7667	54.0088	0.0000	0.0000	0.0000	0.0000	123.6889	240.7470	350.6768 (98)
Space heating												1735.8285 (98)
Space heating per m2										(98) / (4) =		37.9499 (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

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													1858.4888 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	343.3288	269.6012	226.0103	127.7667	54.0088	0.0000	0.0000	0.0000	0.0000	123.6889	240.7470	350.6768	(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)	367.5897	288.6523	241.9811	136.7952	57.8253	0.0000	0.0000	0.0000	0.0000	132.4292	257.7591	375.4570	(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	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973	(64)
Efficiency of water heater	86.9752	86.7301	86.2121	85.0836	83.1487	80.3000	80.3000	80.3000	80.3000	84.8832	86.3838	87.0761	(216)
Fuel for water heating, kWh/month	179.9041	157.5950	164.9525	148.2450	146.8673	133.9414	128.3260	143.0535	144.6333	155.8013	163.4258	175.4756	(219)
Water heating fuel used													1842.2208 (219)
Annual totals kWh/year													
Space heating fuel - main system													1858.4888 (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)													229.2145 (232)
Total delivered energy for all uses													4004.9241 (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	1858.4888	0.2160	401.4336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1842.2208	0.2160	397.9197 (264)
Space and water heating			799.3533 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total CO2, kg/m2/year			957.2406 (272)
Emissions per m2 for space and water heating			17.4760 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6008 (272b)
Emissions per m2 for pumps and fans			0.8510 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.4760 * 1.00) + 2.6008 + 0.8510, rounded to 2 d.p.			20.9300 (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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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) =	0.1830 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3830	(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) =	0.3255 (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	0.4150	0.4069	0.3987	0.3581	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825 (22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5671	0.5731 (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 (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			30.0000	1372.2000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9164.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							200.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss						(33) + (36) =	32.0162 (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	21.1444	21.0238	20.9055	20.3501	20.2462	19.7624	19.7624	19.6728	19.9488	20.2462	20.4564	20.6762 (38)
Heat transfer coeff	53.1606	53.0400	52.9217	52.3663	52.2624	51.7786	51.7786	51.6890	51.9649	52.2624	52.4726	52.6924 (39)
Average = Sum(39)m / 12 =	52.3658 (39)											
HLP	1.1622	1.1596	1.1570	1.1449	1.1426	1.1320	1.1320	1.1301	1.1361	1.1426	1.1472	1.1520 (40)
HLP (average)	1.1449 (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	1.5659 (42)											
Average daily hot water use (litres/day)	71.3891 (43)											
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)	Total = Sum(45)m = 1123.2292 (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	24.7467	21.6436	22.3342	19.4715	18.6834	16.1224	14.9397	17.1436	17.3483	20.2178	22.0693	23.9658	(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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	33.2616	32.2077	30.0191	27.0438	25.1121	22.3922	20.0803	23.0424	24.0949	27.1744	30.6518	32.2121	(72)
Total internal gains	228.9187	227.8268	219.9242	207.0897	193.7956	181.2545	173.2943	176.2944	183.0609	195.9996	210.8393	222.2208	(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						
Southwest	3.9900	36.7938	0.2800	0.7000	0.7700	19.9406	(79)						
Northwest	2.5200	11.2829	0.2800	0.7000	0.7700	3.8620	(81)						
Solar gains	23.8026	41.8274	60.6374	80.8439	95.7648	97.3653	92.9163	81.4340	67.5798	47.1468	28.7436	20.2189	(83)
Total gains	252.7212	269.6541	280.5615	287.9336	289.5604	278.6198	266.2106	257.7284	250.6407	243.1464	239.5829	242.4397	(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	47.8886	47.9976	48.1048	48.6150	48.7117	49.1668	49.1668	49.2520	48.9905	48.7117	48.5165	48.3142		
alpha	4.1926	4.1998	4.2070	4.2410	4.2474	4.2778	4.2778	4.2835	4.2660	4.2474	4.2344	4.2209		
util living area	0.9963	0.9946	0.9907	0.9805	0.9520	0.8735	0.7427	0.7767	0.9230	0.9816	0.9940	0.9969		(86)
MIT	19.4551	19.5764	19.8099	20.1434	20.4868	20.7849	20.9264	20.9080	20.6892	20.2563	19.8029	19.4333		(87)
Th 2	19.9503	19.9525	19.9545	19.9644	19.9662	19.9748	19.9748	19.9764	19.9715	19.9662	19.9625	19.9586		(88)
util rest of house	0.9953	0.9930	0.9879	0.9734	0.9313	0.8101	0.6146	0.6582	0.8804	0.9736	0.9919	0.9961		(89)
MIT 2	18.5404	18.6628	18.8970	19.2350	19.5702	19.8462	19.9476	19.9391	19.7652	19.3496	18.8968	18.5250		(90)
Living area fraction														(91)
MIT	18.9399	19.0619	19.2958	19.6318	19.9706	20.2562	20.3751	20.3624	20.1688	19.7457	19.2926	18.9218		(92)
Temperature adjustment														(93)
adjusted MIT	18.9399	19.0619	19.2958	19.6318	19.9706	20.2562	20.3751	20.3624	20.1688	19.7457	19.2926	18.9218		(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9939	0.9913	0.9855	0.9705	0.9314	0.8302	0.6695	0.7080	0.8902	0.9713	0.9902	0.9949	(94)	
Useful gains	251.1888	267.3034	276.4855	279.4432	269.7005	231.3028	178.2375	182.4616	223.1260	236.1780	237.2281	241.2070	(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	778.2687	751.1460	677.1733	561.9855	432.2405	292.8699	195.4708	204.8110	315.3651	477.9735	639.7781	775.7263	(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	392.1474	325.1422	298.1118	203.4304	120.9297	0.0000	0.0000	0.0000	0.0000	179.8958	289.8360	397.6824	(98)	
Space heating												2207.1757	(98)	
Space heating per m2												(98) / (4) =	48.2548	(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	486.7187	383.1615	392.8364	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7065	0.7962	0.7752	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	343.8510	305.0906	304.5318	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	385.7096	370.1306	361.1906	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	30.1382	48.3898	42.1541	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													120.6820 (104)
Cooled fraction									fC = cooled area / (4) =				1.0000 (105)
Intermittency factor (Table 10b)													
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 kWh	0.0000	0.0000	0.0000	0.0000	0.0000	7.5345	12.0974	10.5385	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													30.1705 (107)
Space cooling per m2													0.6596 (108)
Energy for space heating													48.2548 (99)
Energy for space cooling													0.6596 (108)
Total													48.9144 (109)
Dwelling Fabric Energy Efficiency (DFEE)													48.9 (109)

-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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) =	0.1830 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4330 (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) =	0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (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			45.7400	0.1300	5.9462		(28a)
External Wall	38.8100	8.6300	30.1800	0.1800	5.4324		(29a)
External Wall to Corridor	10.0200		10.0200	0.1800	1.8036		(29a)
Total net area of external elements Aum(A, m2)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 23.9329		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7523 (36)
Total fabric heat loss							(33) + (36) = 30.6852 (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	22.0087	21.8545	21.7033	20.9934	20.8606	20.2422	20.2422	20.1277	20.4804	20.8606	21.1293	21.4102 (38)
Average = Sum(39)m / 12 =	52.6939	52.5397	52.3885	51.6786	51.5458	50.9274	50.9274	50.8129	51.1656	51.5458	51.8145	52.0954 (39)
HLP	1.1520	1.1487	1.1454	1.1298	1.1269	1.1134	1.1134	1.1109	1.1186	1.1269	1.1328	1.1389 (40)
HLP (average)												1.1298 (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)												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy content (annual)	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 (59)
Heat gains from water heating, kWh/month	24.7467	21.6436	22.3342	19.4715	18.6834	16.1224	14.9397	17.1436	17.3483	20.2178	22.0693	23.9658 (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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	33.2616	32.2077	30.0191	27.0438	25.1121	22.3922	20.0803	23.0424	24.0949	27.1744	30.6518	32.2121 (72)
Total internal gains	228.9187	227.8268	219.9242	207.0897	193.7956	181.2545	173.2943	176.2944	183.0609	195.9996	210.8393	222.2208 (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						
Southwest	3.9900	36.7938	0.6300	0.7000	0.7700	44.8662 (79)						
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)						
Solar gains	53.5557	94.1115	136.4341	181.8987	215.4708	219.0719	209.0616	183.2266	152.0545	106.0804	64.6731	45.4924 (83)
Total gains	282.4744	321.9383	356.3582	388.9884	409.2664	400.3264	382.3559	359.5209	335.1154	302.0800	275.5124	267.7132 (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)												21.0000 (85)
tau	60.2800	60.4569	60.6314	61.4643	61.6227	62.3709	62.3709	62.5115	62.0806	61.6227	61.3031	60.9726
alpha	5.0187	5.0305	5.0421	5.0976	5.1082	5.1581	5.1581	5.1674	5.1387	5.1082	5.0869	5.0648
util living area	0.9977	0.9952	0.9882	0.9644	0.8947	0.7412	0.5700	0.6237	0.8581	0.9760	0.9953	0.9983 (86)
MIT	19.7723	19.9207	20.1626	20.4845	20.7666	20.9396	20.9873	20.9803	20.8648	20.5026	20.0814	19.7492 (87)
Th 2	19.9586	19.9613	19.9640	19.9765	19.9789	19.9899	19.9899	19.9919	19.9857	19.9789	19.9741	19.9692 (88)
util rest of house	0.9970	0.9935	0.9839	0.9506	0.8533	0.6516	0.4474	0.5000	0.7893	0.9640	0.9934	0.9977 (89)
MIT 2	18.8430	18.9930	19.2350	19.5589	19.8190	19.9617	19.9866	19.9863	19.9100	19.5825	19.1639	18.8285 (90)
Living area fraction									fLA = Living area / (4) =			0.4368 (91)
MIT	19.2490	19.3983	19.6402	19.9632	20.2329	20.3889	20.4238	20.4205	20.3271	19.9844	19.5647	19.2307 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2490	19.3983	19.6402	19.9632	20.2329	20.3889	20.4238	20.4205	20.3271	19.9844	19.5647	19.2307 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	281.4182	319.4831	350.0246	369.6870	353.9589	275.9016	191.7442	199.3887	273.2028	291.2298	273.4281	266.9444 (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	787.7186	761.7347	688.3957	571.7310	439.8369	294.8113	194.7343	204.2927	318.6117	483.7263	645.8509	783.0297 (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	376.6874	297.1930	251.7481	145.4716	63.8932	0.0000	0.0000	0.0000	0.0000	143.2174	268.1444	383.9675 (98)
Space heating per m2												1930.3227 (98)
												(98) / (4) = 42.2021 (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	478.7177	376.8628	386.1781	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8757	0.9333	0.9141	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	419.2095	351.7096	352.9947	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	527.9641	505.8849	480.1689	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	78.3033	114.7064	94.6176	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												287.6273 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)

# 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	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	19.5758	28.6766	23.6544	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												71.9068 (107)
Energy for space heating												1.5721 (108)
Energy for space cooling												42.2021 (99)
Total												1.5721 (108)
Target Fabric Energy Efficiency (TFEE)												43.7741 (109)
												50.3 (109)

-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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 (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m2)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10994.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							240.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss						(33) + (36) =	32.0162 (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	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m														
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	16.9170	(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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	13.9691	(61)
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(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)
Output from w/h	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(64)
RHI water heating demand													Total per year (kWh/year) = Sum(64)m =	1287.1451 (64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	40.9917	(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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4477	28.8197	23.4378	17.7439	13.2638	11.1978	12.0997	15.7276	21.1096	26.8034	31.2836	33.3495	33.3495 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000	194.3000 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	55.0964 (72)
Total internal gains	372.7356	369.5629	355.4340	333.7606	311.9679	292.2141	280.5256	286.6863	299.0343	320.8708	345.0857	363.0241	363.0241 (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	40.9830	0.2800	0.7000	0.7700	22.2109 (79)							
Northwest	2.5200	12.9465	0.2800	0.7000	0.7700	4.4314 (81)							
Solar gains	26.6423	43.6767	62.3719	87.6367	100.3724	106.4229	100.5317	88.6672	73.7689	51.4831	32.9684	22.4078	22.4078 (83)
Total gains	399.3779	413.2396	417.8059	421.3972	412.3404	398.6370	381.0573	375.3535	372.8032	372.3540	378.0542	385.4319	385.4319 (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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676
util living area	0.9861	0.9818	0.9693	0.9350	0.8480	0.6634	0.4424	0.4489	0.7339	0.9215	0.9746	0.9881	0.9881 (86)
MIT	20.0968	20.1758	20.3670	20.6114	20.8378	20.9661	20.9966	20.9964	20.9428	20.7059	20.3638	20.0689	20.0689 (87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055 (88)
util rest of house	0.9820	0.9764	0.9594	0.9125	0.7940	0.5625	0.3153	0.3201	0.6397	0.8896	0.9657	0.9845	0.9845 (89)
MIT 2	18.8335	18.9473	19.2214	19.5625	19.8542	19.9858	20.0047	20.0047	19.9677	19.6936	19.2191	18.7935	18.7935 (90)
Living area fraction	19.3853	19.4839	19.7218	20.0207	20.2838	20.4140	20.4380	20.4379	20.3937	20.1358	19.7192	19.3506	19.3506 (92)
Temperature adjustment													0.0000
adjusted MIT	19.3853	19.4839	19.7218	20.0207	20.2838	20.4140	20.4380	20.4379	20.3937	20.1358	19.7192	19.3506	19.3506 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9787	0.9728	0.9559	0.9129	0.8106	0.6058	0.3712	0.3767	0.6789	0.8944	0.9625	0.9814	0.9814 (94)
Ext temp.	390.8813	401.9961	399.3987	384.6922	334.2580	241.4859	141.4504	141.4020	253.0784	333.0427	363.8665	378.2651	378.2651 (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	4.7000 (96)
Month fracti	735.0547	714.9641	636.7750	526.5991	389.6095	250.9699	142.0519	142.0454	269.9730	437.2598	601.6041	733.3193	733.3193 (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	1.0000 (97a)
Space heating	256.0650	210.3145	176.6080	102.1730	41.1815	0.0000	0.0000	0.0000	0.0000	77.5376	171.1710	264.1603	264.1603 (98)
RHI space heating demand													1299.2108 (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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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												
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 (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m2)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	27.7851			(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10994.4400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				240.3682			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				4.2311			(36)
Total fabric heat loss			(33) + (36) =	32.0162			(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	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												
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												
Average daily hot water use (litres/day)												
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m													
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	(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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	(61)
Total heat required for water heating calculated for each month													
Solar input	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(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	(63)
Output from w/h	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	(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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4477	28.8197	23.4378	17.7439	13.2638	11.1978	12.0997	15.7276	21.1096	26.8034	31.2836	33.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	(72)
Total internal gains	372.7356	369.5629	355.4340	333.7606	311.9679	292.2141	280.5256	286.6863	299.0343	320.8708	345.0857	363.0241	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	Specific data	Specific data	FF	Access factor	Gains						
	m <sup>2</sup>	Table 6a	g	Specific data		Table 6d	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c									
Southwest	3.9900	36.7938	0.2800	0.7000	0.7700	19.9406 (79)							
Northwest	2.5200	11.2829	0.2800	0.7000	0.7700	3.8620 (81)							
Solar gains	23.8026	41.8274	60.6374	80.8439	95.7648	97.3653	92.9163	81.4340	67.5798	47.1468	28.7436	20.2189	(83)
Total gains	396.5381	411.3903	416.0714	414.6044	407.7327	389.5794	373.4418	368.1203	366.6141	368.0177	373.8293	383.2430	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	
util living area	0.9879	0.9835	0.9737	0.9486	0.8852	0.7443	0.5724	0.6024	0.8093	0.9424	0.9797	0.9898	(86)
MIT	20.0494	20.1412	20.3137	20.5455	20.7762	20.9350	20.9861	20.9818	20.8958	20.6282	20.2948	20.0121	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9843	0.9786	0.9653	0.9308	0.8432	0.6569	0.4517	0.4834	0.7343	0.9192	0.9727	0.9867	(89)
MIT 2	18.7648	18.8974	19.1455	19.4728	19.7800	19.9596	20.0000	19.9976	19.9228	19.5902	19.1204	18.7110	(90)
Living area fraction												fLA = Living area / (4) = 0.4368 (91)	
MIT	19.3259	19.4407	19.6558	19.9414	20.2152	20.3857	20.4307	20.4275	20.3479	20.0436	19.6334	19.2794	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3259	19.4407	19.6558	19.9414	20.2152	20.3857	20.4307	20.4275	20.3479	20.0436	19.6334	19.2794	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9812	0.9751	0.9617	0.9295	0.8531	0.6925	0.5048	0.5356	0.7625	0.9203	0.9694	0.9839	(94)
Useful gains	389.0705	401.1397	400.1335	385.3550	347.8510	269.7838	188.5040	197.1659	279.5423	338.6697	362.3743	377.0602	(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	752.1045	727.8186	658.4962	552.6618	426.2165	289.5941	191.7431	201.5928	312.7285	472.6871	627.3432	754.7793	(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	270.0973	219.5282	192.2218	120.4609	58.3039	0.0000	0.0000	0.0000	0.0000	99.7089	190.7776	281.0230	(98)
Space heating												1432.1216 (98)	
Space heating per m2												(98) / (4) = 31.3100 (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													1531.6809 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	270.0973	219.5282	192.2218	120.4609	58.3039	0.0000	0.0000	0.0000	0.0000	99.7089	190.7776	281.0230	(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)	288.8741	234.7895	205.5848	128.8352	62.3571	0.0000	0.0000	0.0000	0.0000	106.6405	204.0402	300.5593	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.4325	89.3772	89.2488	88.9803	88.4386	87.3000	87.3000	87.3000	87.3000	88.7996	89.2540	87.3000	(216)
Fuel for water heating, kWh/month	145.8429	128.0666	133.3827	118.1131	115.1307	102.2906	96.4142	108.3185	108.9221	122.8219	131.4865	141.6503	(219)
Water heating fuel used													1452.4400 (219)
Annual totals kWh/year													
Space heating fuel - main system													1531.6809 (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)													32.2816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.2816 (231)
Electricity for lighting (calculated in Appendix L)													229.2145 (232)
Total delivered energy for all uses													3320.6170 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1531.6809	3.4800	53.3025 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1452.4400	3.4800	50.5449 (247)
Mechanical ventilation fans	32.2816	13.1900	4.2579 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	229.2145	13.1900	30.2334 (250)
Additional standing charges			120.0000 (251)
Total energy cost			268.2312 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2415 (257)
SAP value		82.6806
SAP rating (Section 12)		B (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	1531.6809	0.2160	330.8431 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1452.4400	0.2160	313.7270 (264)
Space and water heating			644.5701 (265)
Pumps and fans	107.2816	0.5190	55.6791 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total kg/year			819.2116 (272)
CO2 emissions per m2			17.9100 (273)
EI value			87.9023
EI rating			B (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	$3.48 / 0.8852 = 3.931$ , stars = 4
Water heating environmental impact	$0.216 / 0.8852 = 0.2440$ , stars = 4

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



**CALCULATION OF ENERGY RATINGS** 09 Jan 2014

---

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	109.3186 (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:												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 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 (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	27.7851			(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10994.4400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K				240.3682			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				4.2311			(36)
Total fabric heat loss			(33) + (36) =	32.0162			(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	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m														
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	(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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	(61)	
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)	
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	(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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4477	28.8197	23.4378	17.7439	13.2638	11.1978	12.0997	15.7276	21.1096	26.8034	31.2836	33.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	(72)
Total internal gains	372.7356	369.5629	355.4340	333.7606	311.9679	292.2141	280.5256	286.6863	299.0343	320.8708	345.0857	363.0241	(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	40.9830	0.2800	0.7000	0.7700	22.2109 (79)							
Northwest	2.5200	12.9465	0.2800	0.7000	0.7700	4.4314 (81)							
Solar gains	26.6423	43.6767	62.3719	87.6367	100.3724	106.4229	100.5317	88.6672	73.7689	51.4831	32.9684	22.4078	(83)
Total gains	399.3779	413.2396	417.8059	421.3972	412.3404	398.6370	381.0573	375.3535	372.8032	372.3540	378.0542	385.4319	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	
util living area	0.9861	0.9818	0.9693	0.9350	0.8480	0.6634	0.4424	0.4489	0.7339	0.9215	0.9746	0.9881	(86)
MIT	20.0968	20.1758	20.3670	20.6114	20.8378	20.9661	20.9966	20.9964	20.9428	20.7059	20.3638	20.0689	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9820	0.9764	0.9594	0.9125	0.7940	0.5625	0.3153	0.3201	0.6397	0.8896	0.9657	0.9845	(89)
MIT 2	18.8335	18.9473	19.2214	19.5625	19.8542	19.9858	20.0047	20.0047	19.9677	19.6936	19.2191	18.7935	(90)
Living area fraction													fLA = Living area / (4) = 0.4368 (91)
MIT	19.3853	19.4839	19.7218	20.0207	20.2838	20.4140	20.4380	20.4379	20.3937	20.1358	19.7192	19.3506	(92)
Temperature adjustment													0.0000
adjusted MIT	19.3853	19.4839	19.7218	20.0207	20.2838	20.4140	20.4380	20.4379	20.3937	20.1358	19.7192	19.3506	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9787	0.9728	0.9559	0.9129	0.8106	0.6058	0.3712	0.3767	0.6789	0.8944	0.9625	0.9814	(94)
Useful gains	390.8813	401.9961	399.3987	384.6922	334.2580	241.4859	141.4504	141.4020	253.0784	333.0427	363.8665	378.2651	(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	735.0547	714.9641	636.7750	526.5991	389.6095	250.9699	142.0519	142.0454	269.9730	437.2598	601.6041	733.3193	(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	256.0650	210.3145	176.6080	102.1730	41.1815	0.0000	0.0000	0.0000	0.0000	77.5376	171.1710	264.1603	(98)
Space heating													1299.2108 (98)
Space heating per m2													(98) / (4) = 28.4043 (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													1389.5303 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	256.0650	210.3145	176.6080	102.1730	41.1815	0.0000	0.0000	0.0000	0.0000	77.5376	171.1710	264.1603	(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)	273.8663	224.9353	188.8856	109.2760	44.0444	0.0000	0.0000	0.0000	0.0000	82.9279	183.0706	282.5244	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.3942	89.3458	89.1837	88.8486	88.1981	87.3000	87.3000	87.3000	87.3000	88.6018	89.1705	87.3000	(216)
Fuel for water heating, kWh/month	145.9053	128.1117	133.4801	118.2881	115.4447	102.2906	96.4142	108.3185	108.9221	123.0961	131.6095	141.7192	(219)
Water heating fuel used													1453.6000 (219)
Annual totals kWh/year													
Space heating fuel - main system													1389.5303 (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)													32.2816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.2816 (231)
Electricity for lighting (calculated in Appendix L)													229.2145 (232)
Total delivered energy for all uses													3179.6264 (238)

#### 10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1389.5303	3.9300	54.6085 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1453.6000	3.9300	57.1265 (247)
Mechanical ventilation fans	32.2816	17.5600	5.6686 (249)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	229.2145	17.5600	40.2501 (250)
Additional standing charges			88.0000 (251)
Total energy cost			258.8237 (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	1389.5303	0.2160	300.1385 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1453.6000	0.2160	313.9776 (264)
Space and water heating			614.1161 (265)
Pumps and fans	107.2816	0.5190	55.6791 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total kg/year			788.7576 (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	1389.5303	1.2200	1695.2269 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1453.6000	1.2200	1773.3920 (264)
Space and water heating			3468.6189 (265)
Pumps and fans	107.2816	3.0700	329.3544 (267)
Energy for lighting	229.2145	3.0700	703.6886 (268)
Primary energy kWh/year			4501.6619 (272)
Primary energy kWh/m2/year			98.4185 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 83



# 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 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:	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:  
Potential environmental impact rating:

B 83  
B 88

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 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	£59	£59	£0
Mains gas	£200	£200	£0
Space heating	£161	£161	£0
Water heating	£57	£57	£0
Lighting	£40	£40	£0
Total cost of fuels	£259	£259	£0
Total cost of uses	£258	£258	£0
Delivered energy	70 kWh/m <sup>2</sup>	70 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	98 kWh/m <sup>2</sup>	98 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

No improvements selected / applicable  
-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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

No improvements selected / applicable

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

#### Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	240.4 (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	72.15 (P1)
Transmission heat loss coefficient	32.02 (37)
Summer heat loss coefficient	104.17 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South West	0.000	1.000	None
North West	0.720	0.678	Wide overhang

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	0.678	0.491 (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	0.2800	0.7000	0.7650	65.8584
North West	2.5200	100.0415	0.2800	0.7000	0.4913	21.8487
total:						87.7072

	Jun	Jul	Aug	
Solar gains	93	88	78	(P3)
Internal gains	289	278	284	
Total summer gains	382	365	362	(P5)

	3.67	3.51	3.47	
Summer gain/loss ratio				(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 240.4)	0.32	0.32	0.32	
Threshold temperature	19.38	21.42	21.39	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight