

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-223			Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	K Mid As		
Property	59, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	89 B	DER	11.38	TER	14.79
Environmental	90 B	% DER<TER	23.08		
CO ₂ Emissions (t/year)	1.10	DFEE	38.48	TFEE	44.92
General Requirements Compliance	Pass	% DFEE<TFEE	14.35		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 123 m²

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) 14.79 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.38 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 38.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.32 (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	0.16 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.80 (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: 4.44 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.76 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing East: 6.20 m², No overhang
Windows facing West: 7.26 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.99 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								Air changes per hour				
Pressure test								0.0000 / (5) =	0.0000 (8)			
Measured/design AP50								Yes				
Infiltration rate									4.4400			
Number of sides sheltered									0.2220 (18)			
									2 (19)			
Shelter factor								(20) = 1 - [0.075 x (19)] =	0.8500 (20)			
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =	0.1887 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (22b)
Mechanical extract ventilation - decentralised												
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						
Solid Door			2.1200	1.3000	2.7560			(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299			(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148			(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362			(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000	(28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800	(29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800	(29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800	(29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100	(30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500	(30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100	(30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400	(30)					
Total net area of external elements Aum(A, m2)			184.6000					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		51.0182			(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000	(32)					
Timber GF			77.6000			9.0000	698.4000	(32c)					
Timber FF			89.5100			9.0000	805.5900	(32c)					
Timber 2F			49.0500			9.0000	441.4500	(32c)					
Internal Floor			45.3000			18.0000	815.4000	(32d)					
Internal Floor 2			32.3100			18.0000	581.5800	(32d)					
Internal Ceiling			45.3000			18.0000	815.4000	(32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800	(32e)					
Heat capacity Cm = Sum(A x k)			(28) ... (30) + (32) + (32a) ... (32e) =				11630.6500	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934	(36)					
Total fabric heat loss			(33) + (36) =				63.7116	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544	(38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.2660	(39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378	(40)
HLP (average)												0.9378	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

AES
Sustainability
Consultants

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9727	0.9572	0.9233	0.8518	0.7374	0.5915	0.4596	0.5105	0.7242	0.8980	0.9595	0.9765 (86)
MIT	18.8616	19.1177	19.5628	20.1054	20.5566	20.8330	20.9406	20.9184	20.6875	20.0752	19.3546	18.7931 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9689	0.9514	0.9126	0.8309	0.7000	0.5318	0.3804	0.4302	0.6717	0.8789	0.9530	0.9732 (89)
MIT 2	17.2351	17.6058	18.2461	19.0132	19.6268	19.9756	20.0927	20.0733	19.8108	18.9864	17.9533	17.1359 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.1076 (91)
MIT	17.4101	17.7684	18.3877	19.1307	19.7268	20.0678	20.1839	20.1642	19.9051	19.1035	18.1040	17.3141 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2601	17.6184	18.2377	18.9807	19.5768	19.9178	20.0339	20.0142	19.7551	18.9535	17.9540	17.1641 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9502	0.9273	0.8818	0.7972	0.6728	0.5156	0.3706	0.4181	0.6452	0.8451	0.9292	0.9562	(94)
Useful gains	595.4357	676.1220	751.9147	790.2387	729.1282	553.4527	379.5164	393.1309	537.2848	592.7664	571.3846	566.9080	(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	1493.8541	1465.9994	1352.9605	1161.9613	907.9246	612.9592	395.8147	416.5964	651.8380	962.8769	1251.0971	1494.3243	(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	668.4233	530.7976	447.1781	267.6402	133.0245	0.0000	0.0000	0.0000	0.0000	275.3622	489.3930	689.9977	(98)
Space heating												3501.8167	(98)
Space heating per m2											(98) / (4) =	28.4909	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3865.1398	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	668.4233	530.7976	447.1781	267.6402	133.0245	0.0000	0.0000	0.0000	0.0000	275.3622	489.3930	689.9977	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	737.7741	585.8693	493.5740	295.4086	146.8262	0.0000	0.0000	0.0000	0.0000	303.9318	540.1688	761.5869	(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														
Water heating requirement	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827	(64)	
Efficiency of water heater	87.6933	87.4672	86.9572	85.9339	84.1376	79.9000	79.9000	79.9000	79.9000	85.9133	87.2109	87.8105	(216)	
Fuel for water heating, kWh/month	250.7103	221.5649	234.0962	212.4062	212.6360	200.1370	192.2693	210.8976	210.4996	220.3030	229.4131	244.3702	(219)	
Water heating fuel used												2639.3036	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3865.1398	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)														
mechanical ventilation fans (SFP = 0.2302)													87.7670	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													162.7670	(231)
Electricity for lighting (calculated in Appendix L)													500.5042	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =													-675.5997	(233)
Total delivered energy for all uses													6492.1149	(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	3865.1398	0.2160	834.8702	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2639.3036	0.2160	570.0896	(264)
Space and water heating			1404.9598	(265)
Pumps and fans	162.7670	0.5190	84.4761	(267)
Energy for lighting	500.5042	0.5190	259.7617	(268)
Energy saving/generation technologies				
PV Unit	-675.5997	0.5190	-350.6362	(269)
Total CO2, kg/year			1398.5613	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.3800	(273)

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

DER			11.3800	ZC1
Total Floor Area		TFA	122.9100	
Assumed number of occupants		N	2.8739	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.9312	ZC2
CO2 emissions from cooking, equation (L16)			1.5294	ZC3
Total CO2 emissions			26.8406	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			26.8406	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1280 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3780 (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) =				0.3213 (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	0.4097	0.4016	0.3936	0.3534	0.3454	0.3053	0.3053	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5653	0.5713 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			13.4600	1.3258	17.8447		(27)
TER Room Window (Uw = 1.70)			1.5700	1.5918	2.4991		(27a)
150mm EPS B&B			45.3000	0.1300	5.8890		(28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1800	9.1476		(29a)
Wall to Void	21.6200		21.6200	0.1800	3.8916		(29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.1800	0.6336		(29a)
400mm Mineral Wool	18.2900		18.2900	0.1300	2.3777		(30)
Sloping	11.9200	1.5700	10.3500	0.1300	1.3455		(30)
C2V	12.9900		12.9900	0.1300	1.6887		(30)
Dormer Roof	4.5600		4.5600	0.1300	0.5928		(30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.0303		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7023 (36)
Total fabric heat loss						(33) + (36) =	58.7326 (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	60.2072	59.8712	59.5419	57.9949	57.7055	56.3582	56.3582	56.1087	56.8772	57.7055	58.2910	58.9031 (38)
Heat transfer coeff	118.9398	118.6038	118.2744	116.7275	116.4381	115.0908	115.0908	114.8413	115.6097	116.4381	117.0236	117.6357 (39)
Average = Sum(39)m / 12 =												116.7261 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9677	0.9650	0.9623	0.9497	0.9473	0.9364	0.9364	0.9344	0.9406	0.9473	0.9521	0.9571 (40)
HLP (average)												0.9497 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy conte	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1612.0146 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	222.0382	195.7674	205.7455	184.6404	181.0888	162.0211	155.8052	170.6892	170.3008	191.4515	202.1849	216.7647	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	222.0382	195.7674	205.7455	184.6404	181.0888	162.0211	155.8052	170.6892	170.3008	191.4515	202.1849	216.7647	(64)
Total per year (kWh/year) = Sum(64)m =												2258.4977	(64)
Heat gains from water heating, kWh/month													
	99.4966	88.2775	94.0793	86.2338	85.8810	78.7129	77.4742	82.4231	81.4659	89.3266	92.0674	97.7432	(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	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	(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)													
	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	(71)
Water heating gains (Table 5)													
	133.7320	131.3653	126.4507	119.7692	115.4314	109.3235	104.1319	110.7837	113.1471	120.0626	127.8713	131.3752	(72)
Total internal gains													
	520.1357	517.5987	500.4273	472.6869	444.1306	417.1340	399.9807	406.8027	421.4229	449.3973	481.4246	505.8171	(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	
East	6.2000	19.6403	0.6300	0.7000	0.7700	37.2144 (76)
West	7.2600	19.6403	0.6300	0.7000	0.7700	43.5768 (80)
East	1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)

Solar gains	97.2815	191.2606	317.3960	466.7552	575.4876	590.6563	561.6945	480.1622	370.3928	227.5790	121.4695	79.8908	(83)
Total gains	617.4172	708.8594	817.8234	939.4421	1019.6182	1007.7903	961.6752	886.9649	791.8156	676.9763	602.8941	585.7079	(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	71.7625	71.9658	72.1662	73.1226	73.3043	74.1625	74.1625	74.3236	73.8296	73.3043	72.9376	72.5581	
alpha	5.7842	5.7977	5.8111	5.8748	5.8870	5.9442	5.9442	5.9549	5.9220	5.8870	5.8625	5.8372	
util living area	0.9992	0.9980	0.9929	0.9675	0.8792	0.6965	0.5210	0.5843	0.8587	0.9854	0.9981	0.9994	(86)
MIT	19.9177	20.0494	20.2856	20.6007	20.8521	20.9724	20.9957	20.9920	20.9064	20.5685	20.1876	19.8985	(87)
Th 2	20.1103	20.1126	20.1149	20.1255	20.1274	20.1367	20.1367	20.1384	20.1331	20.1274	20.1234	20.1192	(88)
util rest of house	0.9989	0.9973	0.9903	0.9554	0.8379	0.6164	0.4218	0.4807	0.7961	0.9780	0.9974	0.9992	(89)
MIT 2	18.6475	18.8417	19.1874	19.6460	19.9800	20.1180	20.1350	20.1349	20.0551	19.6077	19.0521	18.6260	(90)
Living area fraction													
MIT	18.7841	18.9716	19.3055	19.7487	20.0738	20.2099	20.2276	20.2271	20.1466	19.7110	19.1743	18.7628	(91)
Temperature adjustment												0.0000	
adjusted MIT	18.7841	18.9716	19.3055	19.7487	20.0738	20.2099	20.2276	20.2271	20.1466	19.7110	19.1743	18.7628	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9983	0.9960	0.9870	0.9488	0.8350	0.6236	0.4324	0.4917	0.7973	0.9731	0.9961	0.9987	(94)
Useful gains	616.3686	706.0041	807.1866	891.2975	851.3900	628.4217	415.8419	436.0988	631.2949	658.7460	600.5423	584.9742	(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													
	1722.7360	1668.9482	1514.5668	1266.3411	975.0252	645.6502	417.5042	439.5128	699.0504	1060.8701	1412.9742	1713.1101	(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													
	823.1374	647.0984	526.2909	270.0314	91.9846	0.0000	0.0000	0.0000	0.0000	299.1803	584.9509	839.3331	(98)
Space heating												4082.0070	(98)
Space heating per m2												(98) / (4) =	33.2113 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)																0.0000	(201)
Fraction of space heat from main system(s)																1.0000	(202)
Efficiency of main space heating system 1 (in %)																93.5000	(206)
Efficiency of secondary/supplementary heating system, %																0.0000	(208)
Space heating requirement																4365.7829	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Space heating requirement	823.1374	647.0984	526.2909	270.0314	91.9846	0.0000	0.0000	0.0000	0.0000	299.1803	584.9509	839.3331	(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)	880.3608	692.0839	562.8780	288.8037	98.3792	0.0000	0.0000	0.0000	0.0000	319.9789	625.6160	897.6824	(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	222.0382	195.7674	205.7455	184.6404	181.0888	162.0211	155.8052	170.6892	170.3008	191.4515	202.1849	216.7647	(64)				
Efficiency of water heater (217)m	87.9935	87.7667	87.2133	85.8266	83.1100	79.8000	79.8000	79.8000	79.8000	86.0003	87.4868	88.0761	(216)				
Fuel for water heating, kWh/month	252.3348	223.0544	235.9107	215.1319	217.8906	203.0339	195.2446	213.8962	213.4095	222.6173	231.1032	246.1108	(219)				
Water heating fuel used												2669.7381	(219)				
Annual totals kWh/year																	
Space heating fuel - main system												4365.7829	(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)												500.5042	(232)				
Total delivered energy for all uses												7611.0252	(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	4365.7829	0.2160	943.0091 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2669.7381	0.2160	576.6634 (264)
Space and water heating			1519.6725 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Total CO2, kg/m2/year			1818.3592 (272)
Emissions per m2 for space and water heating			12.3641 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1134 (272b)
Emissions per m2 for pumps and fans			0.3167 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3641 * 1.00) + 2.1134 + 0.3167, rounded to 2 d.p.			14.7900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1280 (8)
Pressure test					Yes
Measured/design AP50					4.4400
Infiltration rate					0.3500 (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) =				0.2975 (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	0.3793	0.3719	0.3645	0.3273	0.3198	0.2826	0.2826	0.2752	0.2975	0.3198	0.3347	0.3496 (22b)
Effective ac	0.5719	0.5692	0.5664	0.5536	0.5511	0.5399	0.5399	0.5379	0.5443	0.5511	0.5560	0.5611 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.1300	1.3258	13.4299		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	51.0182	(33)
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)
Timber GF			77.6000			9.0000	698.4000 (32c)
Timber PF			89.5100			9.0000	805.5900 (32c)
Timber 2F			49.0500			9.0000	441.4500 (32c)
Internal Floor			45.3000			18.0000	815.4000 (32d)
Internal Floor 2			32.3100			18.0000	581.5800 (32d)
Internal Ceiling			45.3000			9.0000	407.7000 (32e)
Internal Ceiling 2			32.3100			9.0000	290.7900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10932.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		88.9444 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.6934 (36)
Total fabric heat loss	(33) + (36) =	63.7116 (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	58.9728	58.6848	58.4024	57.0762	56.8280	55.6729	55.6729	55.4590	56.1179	56.8280	57.3300	57.8548 (38)
Average = Sum(39)m / 12 =	122.6844	122.3964	122.1140	120.7877	120.5396	119.3845	119.3845	119.1706	119.8294	120.5396	121.0416	121.5664 (39)
												120.7866 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9982	0.9958	0.9935	0.9827	0.9807	0.9713	0.9713	0.9696	0.9749	0.9807	0.9848	0.9891 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Energy content (annual)	Total = Sum(45)m =											1612.0146 (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)
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	35.5154	31.0620	32.0532	27.9448	26.8137	23.1382	21.4409	24.6038	24.8976	29.0158	31.6730	34.3948 (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	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	47.7358	46.2232	43.0823	38.8122	36.0399	32.1363	28.8184	33.0696	34.5800	38.9997	43.9902	46.2296 (72)
Total internal gains	431.1395	429.4566	414.0590	388.7299	361.7391	336.9469	321.6672	326.0886	339.8558	365.3344	394.5435	417.6715 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
East	2.8700	19.6403	0.7200	0.7000	0.7700	19.6876 (76)
West	7.2600	19.6403	0.7200	0.7000	0.7700	49.8021 (80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431 (76)
East	1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)

Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888	626.4643	535.7984	413.6375	254.3695	135.8605	89.3820 (83)
Total gains	539.9625	643.2951	768.6375	909.7135	1003.6856	995.6357	948.1314	861.8870	753.4933	619.7039	530.4040	507.0535 (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	24.7522	24.8105	24.8678	25.1409	25.1926	25.4364	25.4364	25.4821	25.3419	25.1926	25.0882	24.9799
alpha	2.6501	2.6540	2.6579	2.6761	2.6795	2.6958	2.6958	2.6988	2.6895	2.6795	2.6725	2.6653
util living area	0.9783	0.9649	0.9354	0.8713	0.7671	0.6273	0.4973	0.5520	0.7619	0.9172	0.9682	0.9816 (86)
MIT	18.4909	18.7705	19.2614	19.8895	20.4167	20.7674	20.9104	20.8792	20.5791	19.8615	19.0610	18.4421 (87)
Th 2	20.0849	20.0868	20.0887	20.0977	20.0994	20.1073	20.1073	20.1088	20.1043	20.0994	20.0960	20.0925 (88)
util rest of house	0.9753	0.9600	0.9262	0.8524	0.7314	0.5669	0.4130	0.4678	0.7119	0.9011	0.9630	0.9790 (89)
MIT 2	17.7583	18.0368	18.5224	19.1396	19.6369	19.9522	20.0620	20.0440	19.7994	19.1248	18.3339	17.7151 (90)
Living area fraction	17.8371	18.1157	18.6019	19.2202	19.7208	20.0398	20.1533	20.1339	19.8833	19.2040	18.4121	0.1076 (91)
MIT	17.8371	18.1157	18.6019	19.2202	19.7208	20.0398	20.1533	20.1339	19.8833	19.2040	18.4121	17.7933 (92)
Temperature adjustment	17.8371	18.1157	18.6019	19.2202	19.7208	20.0398	20.1533	20.1339	19.8833	19.2040	18.4121	0.0000
adjusted MIT	17.8371	18.1157	18.6019	19.2202	19.7208	20.0398	20.1533	20.1339	19.8833	19.2040	18.4121	17.7933 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9651	0.9460	0.9070	0.8304	0.7145	0.5620	0.4176	0.4704	0.6978	0.8808	0.9499	0.9699 (94)
Ext temp.	521.0960	608.5708	697.1903	755.4503	717.0942	559.5269	395.9453	405.3908	525.7789	545.8416	503.8207	491.7741 (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	1660.7956	1617.5531	1477.8095	1246.5596	966.8212	649.4321	424.2064	444.9660	693.0056	1037.1228	1369.2362	1652.4827 (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	847.9365	678.0361	580.7807	353.5987	185.7969	0.0000	0.0000	0.0000	0.0000	365.5132	623.0992	863.5673 (98)
Space heating per m ²	(98) / (4) =											36.5986 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1122.2143	883.4453	905.6965	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7705	0.8305	0.7987	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	864.7081	733.7179	723.3885	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1261.4337	1204.4245	1109.1202	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	285.6424	350.2057	286.9844	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												922.8325	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	71.4106	87.5514	71.7461	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												230.7081	(107)
Space cooling per m2												1.8770	(108)
Energy for space heating												36.5986	(99)
Energy for space cooling												1.8770	(108)
Total												38.4756	(109)
Dwelling Fabric Energy Efficiency (DFEE)												38.5	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1280 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3780 (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) =				0.3213 (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	0.4097	0.4016	0.3936	0.3534	0.3454	0.3053	0.3053	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5653	0.5713 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			13.4600	1.3258	17.8447		(27)
TER Room Window (Uw = 1.70)			1.5700	1.5918	2.4991		(27a)
150mm EPS B&B			45.3000	0.1300	5.8890		(28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1800	9.1476		(29a)
Wall to Void	21.6200		21.6200	0.1800	3.8916		(29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.1800	0.6336		(29a)
400mm Mineral Wool	18.2900		18.2900	0.1300	2.3777		(30)
Sloping	11.9200	1.5700	10.3500	0.1300	1.3455		(30)
C2V	12.9900		12.9900	0.1300	1.6887		(30)
Dormer Roof	4.5600		4.5600	0.1300	0.5928		(30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.0303		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7023 (36)
Total fabric heat loss						(33) + (36) =	58.7326 (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	60.2072	59.8712	59.5419	57.9949	57.7055	56.3582	56.3582	56.1087	56.8772	57.7055	58.2910	58.9031 (38)
Heat transfer coeff	118.9398	118.6038	118.2744	116.7275	116.4381	115.0908	115.0908	114.8413	115.6097	116.4381	117.0236	117.6357 (39)
Average = Sum(39)m / 12 =												116.7261 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9677	0.9650	0.9623	0.9497	0.9473	0.9364	0.9364	0.9344	0.9406	0.9473	0.9521	0.9571 (40)
HLP (average)												0.9497 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy conte	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1612.0146 (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)
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	35.5154	31.0620	32.0532	27.9448	26.8137	23.1382	21.4409	24.6038	24.8976	29.0158	31.6730	34.3948 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	(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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	(71)
Water heating gains (Table 5)	47.7358	46.2232	43.0823	38.8122	36.0399	32.1363	28.8184	33.0696	34.5800	38.9997	43.9902	46.2296	(72)
Total internal gains	431.1395	429.4566	414.0590	388.7299	361.7391	336.9469	321.6672	326.0886	339.8558	365.3344	394.5435	417.6715	(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			
East				6.2000	19.6403	0.6300	0.7000	0.7700	37.2144 (76)			
West				7.2600	19.6403	0.6300	0.7000	0.7700	43.5768 (80)			
East				1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)			
Solar gains	97.2815	191.2606	317.3960	466.7552	575.4876	590.6563	561.6945	480.1622	370.3928	227.5790	121.4695	79.8908 (83)
Total gains	528.4209	620.7173	731.4550	855.4851	937.2267	927.6031	883.3617	806.2508	710.2485	592.9134	516.0130	497.5622 (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	71.7625	71.9658	72.1662	73.1226	73.3043	74.1625	74.1625	74.3236	73.8296	73.3043	72.9376	72.5581	
alpha	5.7842	5.7977	5.8111	5.8748	5.8870	5.9442	5.9442	5.9549	5.9220	5.8870	5.8625	5.8372	
util living area	0.9997	0.9990	0.9959	0.9786	0.9088	0.7421	0.5641	0.6360	0.9002	0.9923	0.9992	0.9998	(86)
MIT	19.8476	19.9804	20.2195	20.5438	20.8166	20.9616	20.9936	20.9877	20.8742	20.5060	20.1193	19.8289	(87)
Th 2	20.1103	20.1126	20.1149	20.1255	20.1274	20.1367	20.1367	20.1384	20.1331	20.1274	20.1234	20.1192	(88)
util rest of house	0.9995	0.9986	0.9944	0.9700	0.8737	0.6620	0.4583	0.5266	0.8477	0.9882	0.9988	0.9997	(89)
MIT 2	19.0416	19.1761	19.4164	19.7444	19.9986	20.1183	20.1349	20.1346	20.0573	19.7121	19.3239	19.0301	(90)
Living area fraction	19.1283	19.2626	19.5027	19.8304	20.0866	20.2090	20.2273	20.2264	20.1452	19.7975	19.4095	19.1160	(91)
MIT	19.1283	19.2626	19.5027	19.8304	20.0866	20.2090	20.2273	20.2264	20.1452	19.7975	19.4095	19.1160	(92)
Temperature adjustment	19.1283	19.2626	19.5027	19.8304	20.0866	20.2090	20.2273	20.2264	20.1452	19.7975	19.4095	19.1160	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9993	0.9982	0.9930	0.9664	0.8717	0.6692	0.4697	0.5382	0.8485	0.9860	0.9984	0.9995	(94)
Ext temp.	528.0736	619.5833	726.3130	826.7143	817.0257	620.7939	414.8954	433.9581	602.6745	584.6240	515.2064	497.3347	(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	1763.6685	1703.4556	1537.8913	1275.8804	976.5142	645.5461	417.4673	439.4241	698.8810	1070.9438	1440.4979	1754.6587	(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	919.2826	728.3622	603.8143	323.3996	118.6594	0.0000	0.0000	0.0000	0.0000	361.8219	666.2098	935.4491	(98)
Space heating per m2												4656.9990	(98)
												37.8895	(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	1081.8532	851.6716	872.7936	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8910	0.9464	0.9208	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	963.9022	806.0232	803.6548	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1181.9151	1128.7196	1044.0908	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	156.9693	240.0861	178.8844	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												575.9398 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.2423	60.0215	44.7211	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.9850 (107)
Space cooling per m2												1.1715 (108)
Energy for space heating												37.8895 (99)
Energy for space cooling												1.1715 (108)
Total												39.0610 (109)
Target Fabric Energy Efficiency (TFEE)												44.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											4.4400		
Number of sides sheltered											0.2220 (18)		
											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1887 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)	
Adj infilt rate	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)	
	0.2076	0.1934	0.1934	0.1840	0.1840	0.1745	0.1745	0.1651	0.1651	0.1793	0.1745	0.1840 (22b)	
Mechanical extract ventilation - decentralised													
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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)					
Total net area of external elements Aum(A, m2)			184.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.0182		(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)					
Timber GF			77.6000			9.0000	698.4000 (32c)					
Timber FF			89.5100			9.0000	805.5900 (32c)					
Timber 2F			49.0500			9.0000	441.4500 (32c)					
Internal Floor			45.3000			18.0000	815.4000 (32d)					
Internal Floor 2			32.3100			18.0000	581.5800 (32d)					
Internal Ceiling			45.3000			18.0000	815.4000 (32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			11630.6500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)					
Total fabric heat loss						(33) + (36) =	63.7116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.2660 (39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9378 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss	(46)m = 0.15 x (45)m									Total = Sum(45)m =		1612.0146 (45)
Water storage loss:	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	Solar input (sum of months) = Sum(63)m =	0.0000	0.0000	0.0000	0.0000 (64)
	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)
	Total per year (kWh/year) = Sum(64)m =											2232.8066 (64)
												2233 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.2404	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	749.1081	743.2948	715.3507	672.2277	627.8006	588.6977	566.4463	576.5446	601.9374	645.2945	693.1925	729.6914 (73)

[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			
East				2.8700	25.1925	0.7200	0.7000	0.7700	25.2533 (76)			
West				7.2600	25.1925	0.7200	0.7000	0.7700	63.8811 (80)			
East				3.3300	25.1925	0.7200	0.7000	0.7700	29.3008 (76)			
East				1.5700	34.2518	0.6300	0.7000	1.0000	21.3434 (82)			
Solar gains	139.7786	233.6688	389.5687	573.4248	666.0084	748.3161	886.9944	614.6881	475.6420	295.8809	173.9414	108.6658 (83)
Total gains	888.8867	976.9637	1104.9194	1245.6525	1293.8090	1337.0138	1253.4406	1191.2327	1077.5794	941.1753	867.1339	838.3572 (84)

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	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9283	0.9063	0.8501	0.7480	0.6014	0.4153	0.2965	0.3110	0.5422	0.7764	0.8938	0.9360 (86)
MIT	19.4183	19.6099	20.0160	20.4536	20.7846	20.9471	20.9858	20.9839	20.8817	20.5015	19.8989	19.3713 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9190	0.8944	0.8312	0.7173	0.5535	0.3520	0.2216	0.2328	0.4764	0.7402	0.8779	0.9275 (89)
MIT 2	18.0364	18.3090	18.8819	19.4812	19.9098	20.0936	20.1284	20.1274	20.0306	19.5614	18.7273	17.9702 (90)
Living area fraction									fLA = Living area / (4) =	0.1076	0.1206	0.1206 (91)
MIT	18.1850	18.4490	19.0039	19.5858	20.0038	20.1854	20.0036	20.2195	20.1222	19.6625	18.8533	18.1209 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0350	18.2990	18.8539	19.4358	19.8538	20.0354	20.0706	20.0695	19.9722	19.5125	18.7033	17.9709 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8890	0.8621	0.7977	0.6893	0.5368	0.3444	0.2158	0.2267	0.4631	0.7099	0.8445	0.8987	(94)
Useful gains	790.2538	842.2280	881.3747	858.6525	694.5102	460.4553	270.5364	270.0326	499.0019	668.1088	732.2533	753.4001	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1456.3883	1429.1791	1297.1953	1087.6263	778.4887	476.6730	273.2483	273.1219	538.5415	865.9334	1187.6179	1437.4686	(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													
	495.6041	394.4311	309.3706	164.8611	62.4800	0.0000	0.0000	0.0000	0.0000	147.1815	327.8625	508.9470	(98)
Space heating												2410.7378	(98)
RHI space heating demand												2411	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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							4.4400					
Infiltration rate							0.2220	(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) =	0.1887 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Mechanical extract ventilation - decentralised	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (22b)
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						
Solid Door			2.1200	1.3000	2.7560			(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299			(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148			(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362			(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000	(28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800	(29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800	(29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800	(29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100	(30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500	(30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100	(30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400	(30)					
Total net area of external elements Aum(A, m2)			184.6000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0182			(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000	(32)					
Timber GF			77.6000			9.0000	698.4000	(32c)					
Timber FF			89.5100			9.0000	805.5900	(32c)					
Timber 2F			49.0500			9.0000	441.4500	(32c)					
Internal Floor			45.3000			18.0000	815.4000	(32d)					
Internal Floor 2			32.3100			18.0000	581.5800	(32d)					
Internal Ceiling			45.3000			18.0000	815.4000	(32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800	(32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	11630.6500			(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934	(36)					
Total fabric heat loss						(33) + (36) =	63.7116	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544	(38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.2660	(39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378	(40)
HLP (average)												0.9378	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0697											
Water storage loss:	25.0697											
Store volume	25.0697											
a) If manufacturer declared loss factor is known (kWh/day):	250.0000 (47)											
Temperature factor from Table 2b	1.7600 (48)											
Enter (49) or (54) in (55)	0.5400 (49)											
Total storage loss	0.9504 (55)											
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624											
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)
Heat gains from water heating, kWh/month	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	749.1081	743.2948	715.3507	672.2277	627.8006	588.6977	566.4463	576.5446	601.9374	645.2945	693.1925	729.6914 (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		
East				2.8700	19.6403	0.7200	0.7000	0.7700		19.6876 (76)		
West				7.2600	19.6403	0.7200	0.7000	0.7700		49.8021 (80)		
East				3.3300	19.6403	0.7200	0.7000	0.7700		22.8431 (76)		
East				1.5700	26.4634	0.6300	0.7000	1.0000		16.4902 (82)		
Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888	626.4643	535.7984	413.6375	254.3695	135.8605	89.3820 (83)
Total gains	857.9311	957.1333	1069.9293	1193.2113	1269.7471	1247.3865	1192.9105	1112.3430	1015.5749	899.6639	829.0530	819.0735 (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	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9429	0.9215	0.8782	0.7962	0.6759	0.5298	0.4033	0.4451	0.6454	0.8367	0.9209	0.9493 (86)
MIT	19.1858	19.4169	19.8105	20.2772	20.6525	20.8750	20.9577	20.9429	20.7726	20.2749	19.6366	19.1160 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9358	0.9118	0.8632	0.7711	0.6362	0.4720	0.3311	0.3711	0.5902	0.8105	0.9095	0.9429 (89)
MIT 2	17.7010	18.0321	18.5922	19.2425	19.7438	20.0183	20.1057	20.0931	19.9062	19.2546	18.3533	17.6008 (90)
Living area fraction	17.8607	18.1810	18.7232	19.3538	19.8415	20.1104	20.1973	20.1845	19.9993	19.3644	18.4913	17.7638 (91)
MIT	17.8607	18.1810	18.7232	19.3538	19.8415	20.1104	20.1973	20.1845	19.9993	19.3644	18.4913	17.7638 (92)
Temperature adjustment	17.7107	18.0310	18.5732	19.2038	19.6915	19.9604	20.0473	20.0345	19.8493	19.2144	18.3413	17.6138 (93)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9084	0.8811	0.8296	0.7398	0.6139	0.4597	0.3235	0.3620	0.5701	0.7769	0.8783	0.9169	(94)
Useful gains	779.3563	843.2929	887.6456	882.7156	779.5147	573.3724	385.8795	402.7030	578.9741	698.9296	728.1852	750.9968	(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	1545.8012	1513.5624	1391.6296	1187.6805	921.1523	617.8724	397.3595	418.9366	662.7044	992.9455	1295.7440	1546.1558	(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	570.2350	450.4211	374.9641	219.5748	105.3784	0.0000	0.0000	0.0000	0.0000	218.7478	408.6423	591.5983	(98)
Space heating												2939.5619	(98)
Space heating per m2												23.9164	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3244.5495	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	570.2350	450.4211	374.9641	219.5748	105.3784	0.0000	0.0000	0.0000	0.0000	218.7478	408.6423	591.5983	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	629.3985	497.1536	413.8677	242.3563	116.3117	0.0000	0.0000	0.0000	0.0000	241.4435	451.0401	652.9783	(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														
Water heating requirement	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827	(64)	
Efficiency of water heater	87.3451	87.0915	86.5230	85.4081	83.5580	79.9000	79.9000	79.9000	79.9000	85.3010	86.7803	87.4817	(217)	
Fuel for water heating, kWh/month	251.7098	222.5208	235.2711	213.7138	214.1110	200.1370	192.2693	210.8976	210.4996	221.8843	230.5516	245.2886	(219)	
Water heating fuel used												2648.8546	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3244.5495	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)														
mechanical ventilation fans (SFP = 0.2302)													87.7670	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													162.7670	(231)
Electricity for lighting (calculated in Appendix L)													500.5042	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =													-675.5997	(233)
Total delivered energy for all uses													5881.0757	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3244.5495	3.4800	112.9103	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2648.8546	3.4800	92.1801	(247)
Mechanical ventilation fans	87.7670	13.1900	11.5765	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	500.5042	13.1900	66.0165	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-675.5997	13.1900	-89.1116	(252)
Total energy cost			323.4643	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8091	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.7131	
SAP rating (Section 12)		89	(258)
SAP band		B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3244.5495	0.2160	700.8227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2648.8546	0.2160	572.1526 (264)
Space and water heating			1272.9753 (265)
Pumps and fans	162.7670	0.5190	84.4761 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1266.5768 (272)
CO2 emissions per m2			10.3000 (273)
EI value			89.8921
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8409 = 4.138$, stars = 4
Water heating environmental impact	$0.216 / 0.8409 = 0.2569$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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													4.4400
Infiltration rate													0.2220 (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) =	0.1887 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000	(22)
Adj infilt rate	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750	(22a)
	0.2076	0.1934	0.1934	0.1840	0.1840	0.1745	0.1745	0.1651	0.1651	0.1793	0.1745	0.1840	(22b)
Mechanical extract ventilation - decentralised													
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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)					
Total net area of external elements Aum(A, m2)			184.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		51.0182		(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)					
Timber GF			77.6000			9.0000	698.4000 (32c)					
Timber FF			89.5100			9.0000	805.5900 (32c)					
Timber 2F			49.0500			9.0000	441.4500 (32c)					
Internal Floor			45.3000			18.0000	815.4000 (32d)					
Internal Floor 2			32.3100			18.0000	581.5800 (32d)					
Internal Ceiling			45.3000			18.0000	815.4000 (32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			11630.6500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)					
Total fabric heat loss						(33) + (36) =	63.7116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.2660 (39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9378 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787 (46)
Water storage loss:												
Store volume	250.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.7600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.9504 (55)											
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)
Heat gains from water heating, kWh/month	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	749.1081	743.2948	715.3507	672.2277	627.8006	588.6977	566.4463	576.5446	601.9374	645.2945	693.1925	729.6914 (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
East				2.8700	25.1925		0.7200		0.7000		0.7700		25.2533 (76)
West				7.2600	25.1925		0.7200		0.7000		0.7700		63.8811 (80)
East				3.3300	25.1925		0.7200		0.7000		0.7700		29.3008 (76)
East				1.5700	34.2518		0.6300		0.7000		1.0000		21.3434 (82)
Solar gains	139.7786	233.6688	389.5687	573.4248	666.0084	748.3161	686.9944	614.6881	475.6420	295.8809	173.9414		108.6658 (83)
Total gains	888.8867	976.9637	1104.9194	1245.6525	1293.8090	1337.0138	1253.4406	1191.2327	1077.5794	941.1753	867.1339		838.3572 (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	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9283	0.9063	0.8501	0.7480	0.6014	0.4153	0.2965	0.3110	0.5422	0.7764	0.8938	0.9360 (86)
MIT	19.4183	19.6099	20.0160	20.4536	20.7846	20.9471	20.9858	20.9839	20.8817	20.5015	19.8989	19.3713 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9190	0.8944	0.8312	0.7173	0.5535	0.3520	0.2216	0.2328	0.4764	0.7402	0.8779	0.9275 (89)
MIT 2	18.0364	18.3090	18.8819	19.4812	19.9098	20.0936	20.1284	20.1274	20.0306	19.5614	18.7273	17.9702 (90)
Living area fraction	18.1850	18.4490	19.0039	19.5858	20.0038	20.1854	20.2206	20.2195	20.1222	19.6625	18.8533	18.1209 (92)
MIT	18.1850	18.4490	19.0039	19.5858	20.0038	20.1854	20.2206	20.2195	20.1222	19.6625	18.8533	18.1209 (92)
Temperature adjustment	18.0350	18.2990	18.8539	19.4358	19.8538	20.0354	20.0706	20.0695	19.9722	19.5125	18.7033	17.9709 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8890	0.8621	0.7977	0.6893	0.5368	0.3444	0.2158	0.2267	0.4631	0.7099	0.8445	0.8987	(94)
Useful gains	790.2538	842.2280	881.3747	858.6525	694.5102	460.4553	270.5364	270.0326	499.0019	668.1088	732.2533	753.4001	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1456.3883	1429.1791	1297.1953	1087.6263	778.4887	476.6730	273.2483	273.1219	538.5415	865.9334	1187.6179	1437.4686	(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	495.6041	394.4311	309.3706	164.8611	62.4800	0.0000	0.0000	0.0000	0.0000	147.1815	327.8625	508.9470	(98)
Space heating												2410.7378	(98)
Space heating per m2											(98) / (4) =	19.6138	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2660.8585	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	495.6041	394.4311	309.3706	164.8611	62.4800	0.0000	0.0000	0.0000	0.0000	147.1815	327.8625	508.9470	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	547.0244	435.3544	341.4686	181.9659	68.9625	0.0000	0.0000	0.0000	0.0000	162.4520	361.8791	561.7516	(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														
Water heating requirement	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827	(64)	
Efficiency of water heater	87.0190	86.7716	86.0279	84.6441	82.4195	79.9000	79.9000	79.9000	79.9000	84.2528	86.2240	87.1391	(217)	
Fuel for water heating, kWh/month	252.6531	223.3410	236.6249	215.6427	217.0686	200.1370	192.2693	210.8976	210.4996	224.6448	232.0389	246.2530	(219)	
Water heating fuel used												2662.0706	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2660.8585	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)														
mechanical ventilation fans (SFP = 0.2302)													87.7670	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													162.7670	(231)
Electricity for lighting (calculated in Appendix L)													500.5042	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 961 * 1.00) =										-760.9470		-760.9470	(233)	
Total delivered energy for all uses												5225.2534	(238)	

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2660.8585	10.2300	272.2058	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2662.0706	10.2300	272.3298	(247)
Mechanical ventilation fans	87.7670	36.7200	32.2280	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	500.5042	36.7200	183.7852	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-760.9470	36.7200	-279.4197	(252)
Total energy cost			611.6691	(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	2660.8585	0.2160	574.7454	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2662.0706	0.2160	575.0073	(264)
Space and water heating			1149.7527	(265)
Pumps and fans	162.7670	0.5190	84.4761	(267)
Energy for lighting	500.5042	0.5190	259.7617	(268)
Energy saving/generation technologies				
PV Unit	-760.9470	0.5190	-394.9315	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Total kg/year 1099.0590 (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	2660.8585	1.2200	3246.2474 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2662.0706	1.2200	3247.7262 (264)
Space and water heating			6493.9736 (265)
Pumps and fans	162.7670	3.0700	499.6946 (267)
Energy for lighting	500.5042	3.0700	1536.5480 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			6194.1089 (272)
Primary energy kWh/m2/year			50.3955 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
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
N Solar water heating	+ 1.4	-£ 123	-272 kg (24.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£123 2.21 kg/m²	B 90	A 92
Total Savings	£123 2.21 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£244	£262	-£18
Mains gas	£648	£507	£141
Space heating	£435	£438	-£3
Water heating	£272	£147	£125
Lighting	£184	£184	£0
Generated (PV)	-£279	-£279	£0
Total cost of fuels	£613	£490	£123
Total cost of uses	£612	£490	£122
Delivered energy	43 kWh/m²	32 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.8 tonnes	0.3 tonnes

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

CO2 emissions per m ²	9 kg/m ²	7 kg/m ²	2 kg/m ²
Primary energy	50 kWh/m ²	38 kWh/m ²	12 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans											= (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50												4.4400	
Infiltration rate												0.2220 (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) =	0.1887 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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													
	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (22b)	
Mechanical extract ventilation - decentralised													
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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)					
Total net area of external elements Aum(A, m2)			184.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.0182		(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)					
Timber GF			77.6000			9.0000	698.4000 (32c)					
Timber FF			89.5100			9.0000	805.5900 (32c)					
Timber 2F			49.0500			9.0000	441.4500 (32c)					
Internal Floor			45.3000			18.0000	815.4000 (32d)					
Internal Floor 2			32.3100			18.0000	581.5800 (32d)					
Internal Ceiling			45.3000			18.0000	815.4000 (32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			11630.6500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)					
Total fabric heat loss						(33) + (36) =	63.7116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.2660 (39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9378 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0697											
Water storage loss:	25.0697											
Store volume	25.0697											
a) If manufacturer declared loss factor is known (kWh/day):	25.0697											
Temperature factor from Table 2b	25.0697											
Enter (49) or (54) in (55)	25.0697											
Total storage loss	25.0697											
If cylinder contains dedicated solar storage	25.0697											
Primary loss	25.0697											
Total heat required for water heating calculated for each month	25.0697											
Aperture area of solar collector	25.0697											
Zero-loss collector efficiency	25.0697											
Collector heat loss coefficient	25.0697											
Collector 2nd order heat loss coefficient	25.0697											
Collector effective heat loss coefficient	25.0697											
Collector performance ratio	25.0697											
Annual solar radiation per m2	25.0697											
Overshading factor	25.0697											
Solar energy available	25.0697											
Adjustment factor for showers	25.0697											
Solar-to-load ratio	25.0697											
Utilisation factor	25.0697											
Collector performance factor	25.0697											
Dedicated solar storage volume	25.0697											
Effective solar volume	25.0697											
Daily hot water demand	25.0697											
Volume ratio Veff/V	25.0697											
Solar storage volume factor	25.0697											
Solar input	25.0697											
Solar input	-27.2310	-45.4407	-77.3907	-103.7189	-128.1359	-125.9780	-124.3132	-108.6130	-85.0658	-58.0899	-32.2999	-22.7877 (63)
Output from w/h	183.7865	140.3725	115.9383	63.5028	29.1379	12.7712	7.4444	38.9590	69.1669	120.9452	159.2198	182.9562 (64)
Heat gains from water heating, kWh/month	90.6801	80.3142	84.1461	72.2988	66.8289	60.0954	58.2360	63.9294	68.6114	79.3934	83.5352	88.9266 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	121.8818	119.5151	113.0996	100.4150	89.8238	83.4658	78.2742	85.9265	95.2937	106.7116	116.0211	119.5250 (72)
Total internal gains	739.6041	733.7908	704.3459	655.2197	604.5393	565.1862	542.9348	554.0336	586.4302	634.2897	683.6885	720.1874 (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
East	2.8700	19.6403	0.7200	0.7000	0.7700	19.6876 (76)
West	7.2600	19.6403	0.7200	0.7000	0.7700	49.8021 (80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431 (76)
East	1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)
Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888
Total gains	848.4271	947.6293	1058.9245	1176.2033	1246.4858	1223.8750

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)	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9443	0.9231	0.8806	0.8009	0.6833	0.5375	0.4104	0.4528	0.6517	0.8402	0.9228	0.9506 (86)
MIT	19.1732	19.4052	19.7989	20.2642	20.6419	20.8702	20.9557	20.9403	20.7666	20.2650	19.6249	19.1031 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9373	0.9136	0.8658	0.7761	0.6438	0.4794	0.3373	0.3780	0.5965	0.8143	0.9117	0.9443 (89)
MIT 2	17.6830	18.0155	18.5762	19.2253	19.7311	20.0134	20.1042	20.0911	19.8995	19.2416	18.3369	17.5823 (90)
Living area fraction									fLA = Living area / (4) =			0.1076 (91)
MIT	17.8433	18.1650	18.7077	19.3370	19.8290	20.1056	20.1958	20.1824	19.9928	19.3517	18.4754	17.7459 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6933	18.0150	18.5577	19.1870	19.6790	19.9556	20.0458	20.0324	19.8428	19.2017	18.3254	17.5959 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9103	0.8831	0.8323	0.7445	0.6209	0.4666	0.3294	0.3686	0.5760	0.7806	0.8807	0.9187 (94)
Useful gains	772.2874	836.8224	881.3344	875.6775	773.9493	571.0853	385.1565	401.6927	576.0172	693.6912	721.7683	743.7335 (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	1543.7906	1511.7164	1389.8396	1185.7470	919.7125	617.3146	397.1849	418.6915	661.9480	991.4784	1293.9112	1544.0941 (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	573.9983	453.5288	378.3279	223.2500	108.4479	0.0000	0.0000	0.0000	0.0000	221.5536	411.9429	595.4683 (98)
Space heating												2966.5177 (98)
Space heating per m2										(98) / (4) =		24.1357 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3274.3021 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	573.9983	453.5288	378.3279	223.2500	108.4479	0.0000	0.0000	0.0000	0.0000	221.5536	411.9429	595.4683 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	633.5523	500.5836	417.5804	246.4129	119.6996	0.0000	0.0000	0.0000	0.0000	244.5404	454.6831	657.2498 (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												
Water heating requirement	183.7865	140.3725	115.9383	63.5028	29.1379	12.7712	7.4444	38.9590	69.1669	120.9452	159.2198	182.9562 (64)
Efficiency of water heater (217)m	87.7500	87.8203	87.8407	87.9905	88.1014	79.9000	79.9000	79.9000	79.9000	86.5090	87.3395	79.9000 (216)
Fuel for water heating, kWh/month	209.4434	159.8407	131.9870	72.1700	33.0731	15.9839	9.3171	48.7597	86.5669	139.8064	182.2999	87.8354 (217)
Water heating fuel used												208.2945 (219)
Annual totals kWh/year												1297.5427 (219)
Space heating fuel - main system												3274.3021 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												87.7670 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												212.7670 (231)
Electricity for lighting (calculated in Appendix L)												500.5042 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =									-675.5997			-675.5997 (233)
Total delivered energy for all uses												4609.5163 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3274.3021	3.4800	113.9457 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1297.5427	3.4800	45.1545 (247)
Mechanical ventilation fans	87.7670	13.1900	11.5765 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	500.5042	13.1900	66.0165 (250)
Additional standing charges			120.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-675.5997	13.1900	-89.1116 (252)
Total energy cost			284.0691 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		$[(255) \times (256)] / [(4) + 45.0] =$	0.7106 (257)
SAP value			90.0878
SAP rating (Section 12)			90 (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	3274.3021	0.2160	707.2493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1297.5427	0.2160	280.2692 (264)
Space and water heating			987.5185 (265)
Pumps and fans	212.7670	0.5190	110.4261 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1007.0700 (272)
CO2 emissions per m2			8.1900 (273)
EI value			91.9631
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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											4.4400	
Infiltration rate											0.2220 (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) =	0.1887 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Adj infilt rate	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
	0.2076	0.1934	0.1934	0.1840	0.1840	0.1745	0.1745	0.1651	0.1651	0.1793	0.1745	0.1840 (22b)
Mechanical extract ventilation - decentralised												
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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)					
Total net area of external elements Aum(A, m2)			184.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		51.0182		(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)					
Timber GF			77.6000			9.0000	698.4000 (32c)					
Timber FF			89.5100			9.0000	805.5900 (32c)					
Timber 2F			49.0500			9.0000	441.4500 (32c)					
Internal Floor			45.3000			18.0000	815.4000 (32d)					
Internal Floor 2			32.3100			18.0000	581.5800 (32d)					
Internal Ceiling			45.3000			18.0000	815.4000 (32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		11630.6500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)					
Total fabric heat loss						(33) + (36) =	63.7116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660 (39)
Average = Sum(39)m / 12 =												115.2660 (39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9378 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy conte	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Energy content (annual)												Total = Sum(45)m = 1612.0146 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9504 (55)
Enter (49) or (54) in (55)												
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	20.6237	18.6278	20.6237	19.9584	20.6237	19.9584	20.6237	20.6237	19.9584	20.6237	19.9584	20.6237 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	211.0175	185.8133	193.3290	167.2216	157.2738	138.7492	131.7575	147.5720	154.2327	179.0351	191.5197	205.7439 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2512 (H8)
Utilisation factor												0.5503 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												102.4549 (H14)
Volume ratio Veff/V												1.2444 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-976.0069 (H17)
Solar input	-32.0402	-45.5591	-78.3051	-105.6517	-123.4799	-133.1336	-126.7328	-115.5087	-90.2586	-62.0716	-37.8951	-25.3705 (63)
												Solar input (sum of months) = Sum(63)m = -976.0069 (63)
Output from w/h	178.9774	140.2542	115.0239	61.5699	33.7938	5.6155	5.0248	32.0634	63.9741	116.9635	153.6246	180.3734 (64)
												Total per year (kWh/year) = Sum(64)m = 1087.2585 (64)
Heat gains from water heating, kWh/month	90.6801	80.3142	84.1461	72.2988	66.8289	60.0954	58.2360	63.9294	68.6114	79.3934	83.5352	88.9266 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9299	0.9081	0.8528	0.7531	0.6089	0.4218	0.3018	0.3166	0.5481	0.7805	0.8961	0.9376 (86)
MIT	19.4063	19.5988	20.0056	20.4429	20.7773	20.9449	20.9851	20.9831	20.8783	20.4937	19.8883	19.3589 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9208	0.8964	0.8341	0.7225	0.5610	0.3577	0.2257	0.2371	0.4820	0.7445	0.8805	0.9292 (89)
MIT 2	18.0194	18.2935	18.8678	19.4676	19.9017	20.0918	20.1280	20.1270	20.0273	19.5516	18.7126	17.9527 (90)
Living area fraction									fLA = Living area / (4) =			0.1076 (91)
MIT	18.1686	18.4339	18.9902	19.5725	19.9959	20.1836	20.2202	20.2190	20.1189	19.6529	18.8391	18.1039 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0186	18.2839	18.8402	19.4225	19.8459	20.0336	20.0702	20.0690	19.9689	19.5029	18.6891	17.9539 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8911	0.8643	0.8006	0.6942	0.5437	0.3499	0.2198	0.2309	0.4684	0.7139	0.8471	0.9007 (94)
Useful gains	783.6120	836.1486	875.7334	852.9279	690.8237	459.5690	270.3562	269.8274	497.4631	664.0742	726.5185	746.5478 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1454.4936	1427.4453	1295.6095	1086.0909	777.5673	476.4615	273.2031	273.0704	538.1627	864.8342	1185.9835	1435.5156 (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	499.1359	397.3514	312.3878	167.8774	64.5373	0.0000	0.0000	0.0000	0.0000	149.3654	330.8148	512.5920 (98)
Space heating												2434.0619 (98)
Space heating per m2										(98) / (4) =		19.8036 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2686.6025 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	499.1359	397.3514	312.3878	167.8774	64.5373	0.0000	0.0000	0.0000	0.0000	149.3654	330.8148	512.5920 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	550.9226	438.5777	344.7989	185.2951	71.2332	0.0000	0.0000	0.0000	0.0000	164.8625	365.1377	565.7748 (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												
Water heating requirement	178.9774	140.2542	115.0239	61.5699	33.7938	5.6155	5.0248	32.0634	63.9741	116.9635	153.6246	180.3734 (64)
Efficiency of water heater	87.5070	87.5415	87.4484	87.4572	86.6137	79.9000	79.9000	79.9000	79.9000	85.5676	86.9092	79.9000 (216)
(217)m	87.5070	87.5415	87.4484	87.4572	86.6137	79.9000	79.9000	79.9000	79.9000	85.5676	86.9092	87.5483 (217)
Fuel for water heating, kWh/month	204.5291	160.2144	131.5335	70.4001	39.0167	7.0282	6.2888	40.1294	80.0677	136.6914	176.7646	206.0274 (219)
Water heating fuel used												1258.6913 (219)
Annual totals kWh/year												
Space heating fuel - main system												2686.6025 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												87.7670 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												212.7670 (231)
Electricity for lighting (calculated in Appendix L)												500.5042 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 961 * 1.00) =										-760.9470		-760.9470 (233)
Total delivered energy for all uses												3897.6180 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2686.6025	10.2300	274.8394 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1258.6913	10.2300	128.7641 (247)
Mechanical ventilation fans	87.7670	36.7200	32.2280 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	500.5042	36.7200	183.7852 (250)
Additional standing charges			103.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-760.9470	36.7200	-279.4197 (252)
Total energy cost			489.0970 (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	2686.6025	0.2160	580.3062 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1258.6913	0.2160	271.8773 (264)
Space and water heating			852.1835 (265)
Pumps and fans	212.7670	0.5190	110.4261 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	0.5190	-394.9315 (269)
Total kg/year			827.4397 (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	2686.6025	1.2200	3277.6551 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1258.6913	1.2200	1535.6034 (264)
Space and water heating			4813.2585 (265)
Pumps and fans	212.7670	3.0700	653.1946 (267)
Energy for lighting	500.5042	3.0700	1536.5480 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			4666.8938 (272)
Primary energy kWh/m2/year			37.9700 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	94.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	412.44 (P1)
Transmission heat loss coefficient	63.71 (37)
Summer heat loss coefficient	476.15 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
West	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs
East	1.000	0.90	1.000
East	1.000	1.00	0.900 (P8)
West	1.000	0.90	1.000
			0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
East	2.8700	125.2818	0.7200	0.7000	0.9000	146.7863
West	7.2600	125.2818	0.7200	0.7000	0.9000	371.3130
East	3.3300	125.2818	0.7200	0.7000	0.9000	170.3130
East	1.5700	199.1355	0.6300	0.7000	1.0000	124.0879
total:						812.5001

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	875	813	712	
	586	563	574	
Total summer gains	1460	1376	1286	(P5)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Summer gain/loss ratio	3.07	2.89	2.70	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 94.6)	1.34	1.34	1.34	
Threshold temperature	19.80	21.53	21.34	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature:	Slight			
