

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-167			Issued on Date	27/09/2022
Assessment Reference	As Built	Prop Type Ref	L Semi Op		
Property	7, Belmere Drive, Fair Oak, EASTLEIGH, SO50 7QS				
SAP Rating	86 B	DER	14.71	TER	18.19
Environmental	88 B	% DER<TER	19.15		
CO ₂ Emissions (t/year)	1.14	DFEE	48.57	TFEE	58.10
General Requirements Compliance	Pass	% DFEE<TFEE	16.40		
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

Semi-Detached House, total floor area 94 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) 18.19 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.71 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.30 (max. 0.35)	OK
Openings	1.43 (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: 4.05 (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 H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG 1.66 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 (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing East: 8.18 m², No overhang
Windows facing West: 4.95 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.64 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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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												4.0500
Infiltration rate												0.2025 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2388	0.2341	0.2295	0.2060	0.2014	0.1779	0.1779	0.1733	0.1873	0.2014	0.2107	0.2201 (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 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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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	2.6731 (42)
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Average daily hot water use (litres/day) 97.6851 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536	(44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484	(46)
Water storage loss:													
Store volume													120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.0600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444	(56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444	(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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293	(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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293	(64)
Heat gains from water heating, kWh/month	85.7895	75.9709	80.6244	73.4369	72.8077	66.2661	64.7923	69.5108	68.8909	76.0929	78.9988	84.1177	(65)
Total per year (kWh/year) = Sum(64)m =													2019.7883 (64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	115.3085	113.0519	108.3661	101.9957	97.8598	92.0363	87.0864	93.4285	95.6819	102.2754	109.7206	113.0614	(72)
Total internal gains	449.8337	447.5882	432.7105	408.6765	384.1380	360.6397	345.4790	351.8101	364.2553	388.5125	416.3603	437.3757	(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				3.6600	19.6403	0.7200	0.7000	0.7700	25.1068 (76)			
West				4.9500	19.6403	0.7200	0.7000	0.7700	33.9560 (80)			
East				4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (76)			
East				1.9700	26.6635	0.6300	0.7000	1.0000	20.8480 (82)			
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	425.7886	260.5866	138.6088	91.0148	(83)
Total gains	560.7508	666.2713	797.0088	946.3893	1048.7414	1043.4498	994.5283	905.5855	790.0439	649.0991	554.9691	528.3906 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	
tau	0.9555	0.9342	0.8919	0.8127	0.6994	0.5654	0.4466	0.4958	0.6941	0.8669	0.9384	0.9608	(86)
alpha	18.1715	18.4908	19.0491	19.7337	20.3194	20.7068	20.8777	20.8407	20.5037	19.7095	18.7995	18.0901	(87)
util living area	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	(88)
MIT	0.9494	0.9253	0.8769	0.7860	0.6550	0.4960	0.3527	0.4010	0.6321	0.8417	0.9285	0.9554	(89)
Th 2	16.1293	16.5893	17.3886	18.3510	19.1443	19.6337	19.8209	19.7891	19.4068	18.3422	17.0426	16.0118	(90)
util rest of house	16.3276	16.7739	17.5499	18.4853	19.2585	19.7379	19.9235	19.8913	19.5133	18.4750	17.2132	16.2137	(91)
Living area fraction	16.1776	16.6239	17.3999	18.3353	19.1085	19.5879	19.7735	19.7413	19.3633	18.3250	17.0632	16.0637	(92)
MIT 2													(93)
Temperature adjustment													
adjusted MIT													

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9167	0.8857	0.8302	0.7386	0.6178	0.4739	0.3408	0.3856	0.5961	0.7928	0.8894	0.9249	(94)
Useful gains	514.0511	590.1151	661.6707	699.0149	647.9066	494.5176	338.9019	349.2381	470.9468	514.5895	493.6104	488.7087	(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)

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Heat loss rate W	1359.4714	1341.8811	1247.5607	1079.9351	847.9467	570.8987	363.2302	382.4286	602.4218	884.1711	1140.3556	1357.8722 (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	628.9927	505.1868	435.9022	274.2625	148.8298	0.0000	0.0000	0.0000	0.0000	274.9687	465.6566	646.6577 (98)
Space heating												3380.4569 (98)
Space heating per m2										(98) / (4) =		36.0774 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3739.4435 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	628.9927	505.1868	435.9022	274.2625	148.8298	0.0000	0.0000	0.0000	0.0000	274.9687	465.6566	646.6577 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	695.7884	558.8349	482.1927	303.3877	164.6348	0.0000	0.0000	0.0000	0.0000	304.1689	515.1068	715.3293 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Efficiency of water heater	87.5601	87.3644	86.9252	86.0590	84.4995	79.7000	79.7000	79.7000	79.7000	85.9713	87.1160	79.7000 (216)
Fuel for water heating, kWh/month	228.8226	201.9215	212.6231	191.8063	190.9057	180.0505	172.1554	189.9610	189.9555	199.1300	208.6805	222.8018 (219)
Water heating fuel used												2388.8136 (219)
Annual totals kWh/year												
Space heating fuel - main system												3739.4435 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												66.2494 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												141.2494 (231)
Electricity for lighting (calculated in Appendix L)												401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.64 * 853 * 1.00) =									-436.7513			-436.7513 (233)
Total delivered energy for all uses												6233.7646 (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	3739.4435	0.2160	807.7198 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2388.8136	0.2160	515.9837 (264)
Space and water heating			1323.7035 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-436.7513	0.5190	-226.6739 (269)
Total CO2, kg/year			1378.4619 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7100 (273)

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

DER		14.7100 ZC1
Total Floor Area		93.7000
Assumed number of occupants		2.6731
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190
CO2 emissions from appliances, equation (L14)		15.5400 ZC2
CO2 emissions from cooking, equation (L16)		1.9547 ZC3
Total CO2 emissions		32.2047 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		32.2047 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.6830 (5)
Dwelling volume			

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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1268 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3768 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3485 (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	0.4443	0.4356	0.4269	0.3833	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095 (22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838 (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)			13.1300	1.3258	17.4072		(27)
TER Room Window (Uw = 1.70)			1.9700	1.5918	3.1358		(27a)
150mm EPS B&B			40.7000	0.1300	5.2910		(28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1800	15.9480		(29a)
Rooflight Stud Wall			5.4000	0.1800	0.9720		(29a)
400mm Mineral Wool	59.6000		59.6000	0.1300	7.7480		(30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.1300	0.0169		(30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.6389		(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)							18.2764 (36)
Total fabric heat loss						(33) + (36) =	70.9153 (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	46.7629	46.4635	46.1700	44.7916	44.5337	43.3332	43.3332	43.1109	43.7956	44.5337	45.0554	45.6009 (38)
Average = Sum(39)m / 12 =	117.6782	117.3788	117.0853	115.7069	115.4490	114.2484	114.2484	114.0261	114.7109	115.4490	115.9707	116.5161 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2559	1.2527	1.2496	1.2349	1.2321	1.2193	1.2193	1.2169	1.2242	1.2321	1.2377	1.2435 (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												2.6731 (42)
Average daily hot water use (litres/day)												97.6851 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Water storage loss:												

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Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2247 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6613 (55)
Total storage loss												
20.5007	18.5168	20.5007	19.8394	20.5007	19.8394	20.5007	20.5007	19.8394	20.5007	19.8394	20.5007	(56)
If cylinder contains dedicated solar storage												
20.5007	18.5168	20.5007	19.8394	20.5007	19.8394	20.5007	20.5007	19.8394	20.5007	19.8394	20.5007	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
203.1136	178.8970	187.5794	167.7339	164.0706	146.1676	139.9641	154.1552	154.0619	173.9509	184.4616	198.0856	(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	(63)
Solar input (sum of months) = Sum(63)m =												
Output from w/h												
203.1136	178.8970	187.5794	167.7339	164.0706	146.1676	139.9641	154.1552	154.0619	173.9509	184.4616	198.0856	(64)
Heat gains from water heating, kWh/month												
87.9945	77.9626	82.8294	75.5708	75.0127	68.4000	66.9973	71.7159	71.0249	78.2979	81.1328	86.3227	(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	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)												
118.2722	116.0157	111.3298	104.9595	100.8236	95.0000	90.0502	96.3923	98.6456	105.2392	112.6844	116.0251	(72)
Total internal gains												
452.7974	450.5519	435.6743	411.6402	387.1017	363.6035	348.4428	354.7739	367.2190	391.4762	419.3241	440.3395	(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				8.1800	19.6403		0.6300		0.7000		0.7700	49.0990 (76)
West				4.9500	19.6403		0.6300		0.7000		0.7700	29.7115 (80)
East				1.9700	26.6635		0.6300		0.7000		1.0000	20.8480 (82)
Solar gains	99.6585	196.6589	328.0274	484.8139	599.7739	616.4455	585.8674	499.5031	383.6041	234.4529	124.5706	81.7563 (83)
Total gains	552.4559	647.2108	763.7017	896.4541	986.8756	980.0490	934.3102	854.2770	750.8231	625.9292	543.8946	522.0958 (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	55.2944	55.4354	55.5744	56.2365	56.3621	56.9543	56.9543	57.0654	56.7247	56.3621	56.1085	55.8459
alpha	4.6863	4.6957	4.7050	4.7491	4.7575	4.7970	4.7970	4.8044	4.7816	4.7575	4.7406	4.7231
util living area												
	0.9981	0.9957	0.9870	0.9531	0.8592	0.6892	0.5250	0.5898	0.8481	0.9779	0.9962	0.9986 (86)
MIT	19.6097	19.7747	20.0707	20.4614	20.7771	20.9448	20.9879	20.9795	20.8470	20.4188	19.9442	19.5847 (87)
Th 2	19.8755	19.8781	19.8805	19.8922	19.8944	19.9046	19.9046	19.9065	19.9007	19.8944	19.8900	19.8854 (88)
util rest of house												
	0.9975	0.9942	0.9823	0.9353	0.8084	0.5933	0.4010	0.4615	0.7736	0.9664	0.9945	0.9981 (89)
MIT 2	18.0294	18.2718	18.7032	19.2656	19.6800	19.8690	19.9003	19.8983	19.7782	19.2173	18.5283	17.9995 (90)
Living area fraction												
MIT	18.1829	18.4177	18.8361	19.3817	19.7865	19.9735	20.0060	20.0033	19.8820	19.3340	18.6658	18.1534 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1829	18.4177	18.8361	19.3817	19.7865	19.9735	20.0060	20.0033	19.8820	19.3340	18.6658	18.1534 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9959	0.9912	0.9759	0.9247	0.8026	0.5998	0.4128	0.4734	0.7721	0.9581	0.9917	0.9968 (94)
Useful gains	550.1793	641.4914	745.2657	828.9142	792.0746	587.8541	385.7059	404.4504	579.7193	599.6805	539.3890	520.4353 (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												
	1633.7088	1586.6948	1444.3707	1212.8091	933.5813	613.9087	389.1265	410.8760	663.2582	1008.3310	1341.2997	1625.8013 (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												
	806.1460	635.1767	520.1341	276.4044	105.2810	0.0000	0.0000	0.0000	0.0000	304.0360	577.3758	822.3923 (98)
Space heating												4046.9461 (98)
Space heating per m2												43.1905 (99)
										(98) / (4) =		

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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													4328.2846	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	806.1460	635.1767	520.1341	276.4044	105.2810	0.0000	0.0000	0.0000	0.0000	304.0360	577.3758	822.3923	(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)	862.1882	679.3333	556.2932	295.6196	112.6000	0.0000	0.0000	0.0000	0.0000	325.1721	617.5142	879.5639	(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	203.1136	178.8970	187.5794	167.7339	164.0706	146.1676	139.9641	154.1552	154.0619	173.9509	184.4616	198.0856	(64)	
Efficiency of water heater (217)m	88.1221	87.9097	87.3941	86.1381	83.6665	79.8000	79.8000	79.8000	79.8000	86.2894	87.6542	88.2043	(216)	
Fuel for water heating, kWh/month	230.4913	203.5009	214.6363	194.7268	196.1008	183.1675	175.3936	193.1769	193.0600	201.5903	210.4423	224.5759	(219)	
Water heating fuel used												2420.8626	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4328.2846	(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)													401.0095	(232)
Total delivered energy for all uses													7225.1567	(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	4328.2846	0.2160	934.9095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2420.8626	0.2160	522.9063 (264)
Space and water heating			1457.8158 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Total CO2, kg/m2/year			1704.8647 (272)
Emissions per m2 for space and water heating			15.5583 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2212 (272b)
Emissions per m2 for pumps and fans			0.4154 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5583 * 1.00) + 2.2212 + 0.4154, rounded to 2 d.p.			18.1900 (273)

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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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1268 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3293 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3046 (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	0.3883	0.3807	0.3731	0.3350	0.3274	0.2893	0.2893	0.2817	0.3046	0.3274	0.3426	0.3579 (22b)
Effective ac	0.5754	0.5725	0.5696	0.5561	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5640 (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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall			5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4390		(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			9.0000	279.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7571.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							80.8046 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	44.9413	44.7126	44.4885	43.4357	43.2388	42.3219	42.3219	42.1521	42.6750	43.2388	43.6372	44.0538 (38)
Heat transfer coeff	120.3451	120.1164	119.8923	118.8396	118.6426	117.7257	117.7257	117.5559	118.0789	118.6426	119.0411	119.4576 (39)
Average = Sum(39)m / 12 =												118.8386 (39)
HLP	1.2844	1.2819	1.2795	1.2683	1.2662	1.2564	1.2564	1.2546	1.2602	1.2662	1.2704	1.2749 (40)
HLP (average)												1.2683 (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												2.6731 (42)
Average daily hot water use (litres/day)												97.6851 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Energy content (annual)										Total = Sum	(45)m =	1536.9663 (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	33.8620	29.6159	30.5610	26.6438	25.5654	22.0610	20.4427	23.4583	23.7385	27.6649	30.1984	32.7935 (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	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	45.5134	44.0713	41.0766	37.0053	34.3620	30.6402	27.4768	31.5300	32.9701	37.1840	41.9422	44.0773	(72)
Total internal gains	377.0386	375.6075	362.4210	340.6860	317.6402	296.2437	282.8694	286.9116	298.5435	320.4211	345.5819	365.3917	(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				3.6600	19.6403	0.7200	0.7000	0.7700	25.1068 (76)			
West				4.9500	19.6403	0.7200	0.7000	0.7700	33.9560 (80)			
East				4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (76)			
East				1.9700	26.6635	0.6300	0.7000	1.0000	20.8480 (82)			
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088	91.0148 (83)
Total gains	487.9558	594.2907	726.7192	878.3988	982.2437	979.0538	931.9186	840.6870	724.3321	581.0077	484.1907	456.4065 (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	17.4761	17.5094	17.5421	17.6975	17.7269	17.8650	17.8650	17.8908	17.8115	17.7269	17.6676	17.6059	
alpha	2.1651	2.1673	2.1695	2.1798	2.1818	2.1910	2.1910	2.1927	2.1874	2.1818	2.1778	2.1737	
util living area	0.9643	0.9450	0.9064	0.8321	0.7246	0.5932	0.4753	0.5278	0.7256	0.8874	0.9503	0.9688	(86)
MIT	17.8479	18.1873	18.7849	19.5434	20.1925	20.6427	20.8447	20.7991	20.4024	19.5191	18.5411	17.7844	(87)
Th 2	19.8531	19.8550	19.8569	19.8657	19.8674	19.8751	19.8751	19.8766	19.8722	19.8674	19.8641	19.8606	(88)
util rest of house	0.9592	0.9372	0.8929	0.8070	0.6810	0.5226	0.3764	0.4291	0.6652	0.8650	0.9420	0.9644	(89)
MIT 2	16.9786	17.3148	17.9028	18.6414	19.2488	19.6489	19.8032	19.7772	19.4593	18.6367	17.6752	16.9205	(90)
Living area fraction									fLA = Living area / (4) =			0.0971	(91)
MIT	17.0630	17.3995	17.9884	18.7290	19.3404	19.7454	19.9043	19.8764	19.5509	18.7224	17.7593	17.0044	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0630	17.3995	17.9884	18.7290	19.3404	19.7454	19.9043	19.8764	19.5509	18.7224	17.7593	17.0044	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	459.3907	543.4120	627.9529	682.0239	646.1087	502.8425	353.3935	360.6912	467.1209	485.4004	445.6525	432.7902	(94)
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	1535.9649	1501.3948	1377.3757	1168.0728	906.4806	605.7437	389.0044	408.6758	643.6390	963.6589	1268.8948	1529.5876	(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	800.9712	643.7644	557.5706	349.9552	193.7167	0.0000	0.0000	0.0000	0.0000	355.8243	592.7345	816.0173	(98)
Space heating												4310.5541	(98)
Space heating per m2												(98) / (4) =	46.0038 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	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	1106.6215	871.1701	893.4248	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7195	0.7792	0.7443	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	796.2232	678.7810	665.0195	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1220.4030	1164.5756	1063.8626	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	305.4095	361.4312	296.7393	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												963.5800	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	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	76.3524	90.3578	74.1848	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												240.8950	(107)
Energy for space heating												2.5709	(108)
Energy for space cooling												46.0038	(99)
Total												2.5709	(108)
Dwelling Fabric Energy Efficiency (DFEE)												48.5747	(109)
												48.6	(109)

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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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																3 * 10 =	30.0000 (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) =					30.0000	/ (5) =	0.1268 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3768 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3485 (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	0.4443	0.4356	0.4269	0.3833	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)				
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			13.1300	1.3258	17.4072			(27)					
TER Room Window (Uw = 1.70)			1.9700	1.5918	3.1358			(27a)					
150mm EPS B&B			40.7000	0.1300	5.2910			(28a)					
140mm Timber Frame	103.8500	15.2500	88.6000	0.1800	15.9480			(29a)					
Rooflight Stud Wall	5.4000		5.4000	0.1800	0.9720			(29a)					
400mm Mineral Wool	59.6000		59.6000	0.1300	7.7480			(30)					
Rooflight Sloping	2.1000	1.9700	0.1300	0.1300	0.0169			(30)					
Total net area of external elements Aum(A, m2)			211.6500					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6389			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								18.2764 (36)					
Total fabric heat loss						(33) + (36) =		70.9153 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 46.7629	Feb 46.4635	Mar 46.1700	Apr 44.7916	May 44.5337	Jun 43.3332	Jul 43.3332	Aug 43.1109	Sep 43.7956	Oct 44.5337	Nov 45.0554	Dec 45.6009	(38)
Heat transfer coeff	117.6782	117.3788	117.0853	115.7069	115.4490	114.2484	114.2484	114.0261	114.7109	115.4490	115.9707	116.5161	(39)
Average = Sum(39)m / 12 =												115.7056	(39)
HLP	Jan 1.2559	Feb 1.2527	Mar 1.2496	Apr 1.2349	May 1.2321	Jun 1.2193	Jul 1.2193	Aug 1.2169	Sep 1.2242	Oct 1.2321	Nov 1.2377	Dec 1.2435	(40)
HLP (average)												1.2349	(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												2.6731 (42)
Average daily hot water use (litres/day)												97.6851 (43)
Daily hot water use	Jan 107.4536	Feb 103.5462	Mar 99.6388	Apr 95.7314	May 91.8240	Jun 87.9165	Jul 87.9165	Aug 91.8240	Sep 95.7314	Oct 99.6388	Nov 103.5462	Dec 107.4536 (44)
Energy conte	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Energy content (annual)												Total = Sum(45)m = 1536.9663 (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:												

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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	33.8620	29.6159	30.5610	26.6438	25.5654	22.0610	20.4427	23.4583	23.7385	27.6649	30.1984	32.7935 (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	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	133.6527	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.7068	20.1680	16.4017	12.4172	9.2820	7.8362	8.4673	11.0061	14.7724	18.7570	21.8922	23.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.7226	248.2724	241.8469	228.1678	210.9004	194.6714	183.8295	181.2797	187.7052	201.3843	218.6517	234.8806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	36.3653	(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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	(71)
Water heating gains (Table 5)	45.5134	44.0713	41.0766	37.0053	34.3620	30.6402	27.4768	31.5300	32.9701	37.1840	41.9422	44.0773	(72)
Total internal gains	377.0386	375.6075	362.4210	340.6860	317.6402	296.2437	282.8694	286.9116	298.5435	320.4211	345.5819	365.3917	(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	8.1800	19.6403	0.6300	0.7000	0.7700	49.0990 (76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115 (80)
East	1.9700	26.6635	0.6300	0.7000	1.0000	20.8480 (82)

Solar gains	99.6585	196.6589	328.0274	484.8139	599.7739	616.4455	585.8674	499.5031	383.6041	234.4529	124.5706	81.7563	(83)
Total gains	476.6971	572.2664	690.4484	825.4999	917.4141	912.6892	868.7368	786.4148	682.1476	554.8740	470.1525	447.1479	(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	55.2944	55.4354	55.5744	56.2365	56.3621	56.9543	56.9543	57.0654	56.7247	56.3621	56.1085	55.8459	
alpha	4.6863	4.6957	4.7050	4.7491	4.7575	4.7970	4.7970	4.8044	4.7816	4.7575	4.7406	4.7231	
util living area	0.9990	0.9974	0.9913	0.9649	0.8844	0.7251	0.5602	0.6319	0.8823	0.9862	0.9979	0.9993	(86)
MIT	19.5358	19.7022	20.0025	20.4043	20.7409	20.9313	20.9841	20.9727	20.8125	20.3547	19.8726	19.5112	(87)
Th 2	19.8755	19.8781	19.8805	19.8922	19.8944	19.9046	19.9046	19.9065	19.9007	19.8944	19.8900	19.8854	(88)
util rest of house	0.9987	0.9965	0.9880	0.9509	0.8388	0.6295	0.4300	0.4985	0.8166	0.9786	0.9971	0.9990	(89)
MIT 2	18.5413	18.7094	19.0098	19.4116	19.7200	19.8734	19.9007	19.8988	19.7935	19.3710	18.8891	18.5245	(90)
Living area fraction	18.6379	18.8058	19.1062	19.5080	19.8192	19.9762	20.0059	20.0031	19.8925	19.4665	18.9846	18.6203	(91)
MIT	18.6379	18.8058	19.1062	19.5080	19.8192	19.9762	20.0059	20.0031	19.8925	19.4665	18.9846	18.6203	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6379	18.8058	19.1062	19.5080	19.8192	19.9762	20.0059	20.0031	19.8925	19.4665	18.9846	18.6203	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9953	0.9849	0.9446	0.8351	0.6364	0.4426	0.5111	0.8160	0.9744	0.9960	0.9986	(94)
Useful gains	475.7811	569.5512	680.0127	779.7337	766.1093	580.8052	384.5163	401.9702	556.6308	540.6595	468.2573	446.5156	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1687.2561	1632.2442	1476.0045	1227.4167	937.3530	614.2174	389.1192	410.8450	664.4586	1023.6276	1378.2693	1680.1972	(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	901.3374	714.1297	592.2179	322.3318	127.4053	0.0000	0.0000	0.0000	0.0000	359.3283	655.2086	917.8591	(98)
Space heating												4589.8181	(98)
Space heating per m2											(98) / (4) =	48.9842	(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	1073.9353	845.4384	866.5985	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8522	0.9141	0.8813	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	915.1799	772.8390	763.7690	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1142.8340	1090.7268	1000.4275	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	163.9109	236.5085	176.0739	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												576.4934 (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	40.9777	59.1271	44.0185	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												144.1233 (107)
Space cooling per m2												1.5381 (108)
Energy for space heating												48.9842 (99)
Energy for space cooling												1.5381 (108)
Total												50.5223 (109)
Target Fabric Energy Efficiency (TFEE)												58.1 (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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.6830 (5)
Dwelling volume			

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												4.0500
Infiltration rate												0.2025 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)
Wind factor	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)
Adj infilt rate												
	0.2060	0.1920	0.1920	0.1826	0.1826	0.1733	0.1733	0.1639	0.1639	0.1779	0.1733	0.1826 (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 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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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	2.6731 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Average daily hot water use (litres/day)												97.6851 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum (45)m = 1536.9663 (45)
Water storage loss:	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
RHI water heating demand												2019.7883 (64)
Heat gains from water heating, kWh/month	85.7895	75.9709	80.6244	73.4369	72.8077	66.2661	64.7923	69.5108	68.8909	76.0929	78.9988	84.1177 (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	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114 (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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222 (71)
Water heating gains (Table 5)	115.3085	113.0519	108.3661	101.9957	97.8598	92.0363	87.0864	93.4285	95.6819	102.2754	109.7206	113.0614 (72)
Total internal gains	648.9981	644.2002	620.5084	583.7600	546.0139	512.3537	492.7996	501.6830	522.9424	559.9139	600.9693	632.1467 (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					3.6600	25.1925	0.7200	0.7000			0.7700			32.2045 (76)
West					4.9500	25.1925	0.7200	0.7000			0.7700			43.5553 (80)
East					4.5200	25.1925	0.7200	0.7000			0.7700			39.7717 (76)
East					1.9700	34.6424	0.6300	0.7000			1.0000			27.0867 (82)

Solar gains	142.6182	239.2173	400.6577	592.3733	690.0394	776.2467	712.2715	635.8502	490.0971	303.4334	177.6478			110.7661 (83)
Total gains	791.6163	883.4175	1021.1661	1176.1333	1236.0533	1288.6004	1205.0711	1137.5333	1013.0394	863.3472	778.6171			742.9128 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9056	0.8801	0.8196	0.7175	0.5807	0.4086	0.2976	0.3134	0.5333	0.7529	0.8690	0.9145 (86)
MIT	18.8026	19.0450	19.5672	20.1464	20.6166	20.8824	20.9608	20.9564	20.7695	20.2184	19.4259	18.7491 (87)
Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.8931	0.8646	0.7963	0.6813	0.5252	0.3329	0.2044	0.2160	0.4559	0.7102	0.8489	0.9029 (89)
MIT 2	17.0340	17.3774	18.1115	18.9029	19.5130	19.8149	19.8855	19.8834	19.7073	19.0257	17.9291	16.9594 (90)
Living area fraction	17.2058	17.5393	18.2529	19.0236	19.6202	19.9185	19.9899	19.9876	19.8104	19.1415	18.0745	17.1332 (92)
MIT	17.2058	17.5393	18.2529	19.0236	19.6202	19.9185	19.9899	19.9876	19.8104	19.1415	18.0745	17.1332 (92)
Temperature adjustment	17.0558	17.3893	18.1029	18.8736	19.4702	19.7685	19.8399	19.8376	19.6604	18.9915	17.9245	16.9832 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8481	0.8172	0.7486	0.6419	0.5011	0.3230	0.1999	0.2099	0.4371	0.6675	0.8005	0.8591 (94)
	671.3764	721.9397	764.4684	754.9935	619.3715	416.2656	239.6605	238.7567	442.7661	576.2587	623.3175	638.2685 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	1334.0827	1315.0273	1202.1255	1015.6453	729.1123	442.7807	244.9299	244.6593	499.0785	800.2265	1090.1387	1314.3277 (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	493.0534	398.5549	325.6169	187.6693	81.6472	0.0000	0.0000	0.0000	0.0000	166.6321	336.1113	502.9881 (98)
Space heating												2492.2731 (98)
RHI space heating demand												2492 (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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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												4.0500
Infiltration rate												0.2025 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2388	0.2341	0.2295	0.2060	0.2014	0.1779	0.1779	0.1733	0.1873	0.2014	0.2107	0.2201 (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 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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss			(33) + (36) =				75.4038 (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	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215 (40)
HLP (average)												1.2215 (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	2.6731 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Average daily hot water use (litres/day)												97.6851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Water storage loss:												
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Heat gains from water heating, kWh/month	85.7895	75.9709	80.6244	73.4369	72.8077	66.2661	64.7923	69.5108	68.8909	76.0929	78.9988	84.1177 (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	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114 (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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222 (71)
Water heating gains (Table 5)	115.3085	113.0519	108.3661	101.9957	97.8598	92.0363	87.0864	93.4285	95.6819	102.2754	109.7206	113.0614 (72)
Total internal gains	648.9981	644.2002	620.5084	583.7600	546.0139	512.3537	492.7996	501.6830	522.9424	559.9139	600.9693	632.1467 (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					3.6600	19.6403	0.7200	0.7000	0.7700	25.1068 (76)		
West					4.9500	19.6403	0.7200	0.7000	0.7700	33.9560 (80)		
East					4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (76)		
East					1.9700	26.6635	0.6300	0.7000	1.0000	20.8480 (82)		
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088	91.0148 (83)
Total gains	759.9152	862.8834	984.8066	1121.4728	1210.6174	1195.1637	1141.8488	1055.4584	948.7309	820.5005	739.5781	723.1616 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9220	0.8964	0.8481	0.7636	0.6485	0.5151	0.3998	0.4414	0.6285	0.8103	0.8976	0.9294 (86)
MIT	18.5103	18.8013	19.3048	19.9132	20.4255	20.7596	20.9031	20.8753	20.6022	19.9195	19.0937	18.4281 (87)
Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.9121	0.8834	0.8290	0.7334	0.6024	0.4476	0.3126	0.3525	0.5643	0.7786	0.8826	0.9203 (89)
MIT 2	16.6131	17.0282	17.7423	18.5876	19.2718	19.6861	19.8392	19.8160	19.5151	18.6207	17.4564	16.4957 (90)
Living area fraction	16.7973	17.2004	17.8940	18.7163	19.3838	19.7903	19.9425	19.9189	19.6207	18.7468	17.6154	16.6833 (92)
Temperature adjustment	16.6473	17.0504	17.7440	18.5663	19.2338	19.6403	19.7925	19.7689	19.4707	18.5968	17.4654	-0.1500
adjusted MIT	16.6473	17.0504	17.7440	18.5663	19.2338	19.6403	19.7925	19.7689	19.4707	18.5968	17.4654	16.5333 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8699	0.8374	0.7807	0.6895	0.5708	0.4301	0.3032	0.3409	0.5356	0.7312	0.8363	0.8797 (94)
Ext temp.	661.0235	722.6136	768.8484	773.2556	690.9670	513.9816	346.2450	359.7531	508.1284	599.9534	618.5034	636.1459 (95)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Heat loss rate W	1413.2344	1390.6892	1286.9542	1106.3760	862.2957	576.9003	365.4074	385.5924	614.7111	915.2874	1186.3906	1411.6304 (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	559.6449	448.9468	385.4707	239.8467	127.4685	0.0000	0.0000	0.0000	0.0000	234.6085	408.8788	576.9605 (98)
Space heating												2981.8255 (98)
Space heating per m2										(98) / (4) =		31.8231 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3298.4796 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	559.6449	448.9468	385.4707	239.8467	127.4685	0.0000	0.0000	0.0000	0.0000	234.6085	408.8788	576.9605 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	619.0762	496.6226	426.4057	265.3171	141.0050	0.0000	0.0000	0.0000	0.0000	259.5227	452.2996	638.2306 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Efficiency of water heater	87.3099	87.1013	86.6307	85.7092	84.0935	79.7000	79.7000	79.7000	79.7000	85.5545	86.8129	79.7000 (216)
Fuel for water heating, kWh/month	229.4785	202.5313	213.3459	192.5891	191.8274	180.0505	172.1554	189.9610	189.9555	200.1002	209.4092	223.4091 (219)
Water heating fuel used												2394.8129 (219)
Annual totals kWh/year												
Space heating fuel - main system												3298.4796 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												66.2494 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												141.2494 (231)
Electricity for lighting (calculated in Appendix L)												401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.64 * 853 * 1.00) =									-436.7513			-436.7513 (233)
Total delivered energy for all uses												5798.8000 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3298.4796	3.4800	114.7871 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2394.8129	3.4800	83.3395 (247)
Mechanical ventilation fans	66.2494	13.1900	8.7383 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	401.0095	13.1900	52.8931 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-436.7513	13.1900	-57.6075 (252)
Total energy cost			332.0430 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0055 (257)
SAP value		85.9738
SAP rating (Section 12)		86 (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	3298.4796	0.2160	712.4716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2394.8129	0.2160	517.2796 (264)
Space and water heating			1229.7512 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-436.7513	0.5190	-226.6739 (269)
Total kg/year			1284.5096 (272)
CO2 emissions per m2			13.7100 (273)
EI value			87.5902
EI rating			88 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8412 = 4.137$, stars = 4
Water heating environmental impact	$0.216 / 0.8412 = 0.2568$, 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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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												4.0500
Infiltration rate												0.2025 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)
Wind factor	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)
Adj infilt rate												
	0.2060	0.1920	0.1920	0.1826	0.1826	0.1733	0.1733	0.1639	0.1639	0.1779	0.1733	0.1826 (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 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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4390			(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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	2.6731 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												97.6851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Water storage loss:												
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5724 (55)
Total storage loss	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (56)
If cylinder contains dedicated solar storage	17.7444	16.0272	17.7444	17.1720	17.7444	17.1720	17.7444	17.7444	17.1720	17.7444	17.1720	17.7444 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Heat gains from water heating, kWh/month	85.7895	75.9709	80.6244	73.4369	72.8077	66.2661	64.7923	69.5108	68.8909	76.0929	78.9988	84.1177 (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	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114 (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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222 (71)
Water heating gains (Table 5)	115.3085	113.0519	108.3661	101.9957	97.8598	92.0363	87.0864	93.4285	95.6819	102.2754	109.7206	113.0614 (72)
Total internal gains	648.9981	644.2002	620.5084	583.7600	546.0139	512.3537	492.7996	501.6830	522.9424	559.9139	600.9693	632.1467 (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					3.6600	25.1925	0.7200	0.7000	0.7700	32.2045 (76)		
West					4.9500	25.1925	0.7200	0.7000	0.7700	43.5553 (80)		
East					4.5200	25.1925	0.7200	0.7000	0.7700	39.7717 (76)		
East					1.9700	34.6424	0.6300	0.7000	1.0000	27.0867 (82)		
Solar gains	142.6182	239.2173	400.6577	592.3733	690.0394	776.2467	712.2715	635.8502	490.0971	303.4334	177.6478	110.7661 (83)
Total gains	791.6163	883.4175	1021.1661	1176.1333	1236.0533	1288.6004	1205.0711	1137.5333	1013.0394	863.3472	778.6171	742.9128 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9056	0.8801	0.8196	0.7175	0.5807	0.4086	0.2976	0.3134	0.5333	0.7529	0.8690	0.9145 (86)
MIT	18.8026	19.0450	19.5672	20.1464	20.6166	20.8824	20.9608	20.9564	20.7695	20.2184	19.4259	18.7491 (87)
Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.8931	0.8646	0.7963	0.6813	0.5252	0.3329	0.2044	0.2160	0.4559	0.7102	0.8489	0.9029 (89)
MIT 2	17.0340	17.3774	18.1115	18.9029	19.5130	19.8149	19.8855	19.8834	19.7073	19.0257	17.9291	16.9594 (90)
Living area fraction	17.2058	17.5393	18.2529	19.0236	19.6202	19.9185	19.9899	19.9876	19.8104	19.1415	18.0745	17.1332 (92)
Temperature adjustment	17.0558	17.3893	18.1029	18.8736	19.4702	19.7685	19.8399	19.8376	19.6604	18.9915	17.9245	16.9832 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8481	0.8172	0.7486	0.6419	0.5011	0.3230	0.1989	0.2099	0.4371	0.6675	0.8005	0.8591 (94)
Ext temp.	671.3764	721.9397	764.4684	754.9935	619.3715	416.2656	239.6605	238.7567	442.7661	576.2587	623.3175	638.2685 (95)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Heat loss rate W	1334.0827	1315.0273	1202.1255	1015.6453	729.1123	442.7807	244.9299	244.6593	499.0785	800.2265	1090.1387	1314.3277 (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	493.0534	398.5549	325.6169	187.6693	81.6472	0.0000	0.0000	0.0000	0.0000	166.6321	336.1113	502.9881 (98)
Space heating												2492.2731 (98)
Space heating per m2											(98) / (4) =	26.5984 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2756.9393 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	493.0534	398.5549	325.6169	187.6693	81.6472	0.0000	0.0000	0.0000	0.0000	166.6321	336.1113	502.9881 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	545.4131	440.8793	360.1956	207.5988	90.3177	0.0000	0.0000	0.0000	0.0000	184.3275	371.8046	556.4028 (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	200.3573	176.4074	184.8231	165.0665	161.3143	143.5003	137.2078	151.3989	151.3945	171.1946	181.7942	195.3293 (64)
Efficiency of water heater	87.0242	86.8236	86.2093	85.0563	83.0015	79.7000	79.7000	79.7000	79.7000	84.6416	86.3316	79.7000 (216)
Fuel for water heating, kWh/month	230.2318	203.1790	214.3889	194.0674	194.3512	180.0505	172.1554	189.9610	189.9555	202.2584	210.5767	224.1863 (219)
Water heating fuel used												2405.3620 (219)
Annual totals kWh/year												
Space heating fuel - main system												2756.9393 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												66.2494 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												141.2494 (231)
Electricity for lighting (calculated in Appendix L)												401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.64 * 961 * 1.00) =									-491.9253			-491.9253 (233)
Total delivered energy for all uses												5212.6348 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2756.9393	3.7400	103.1095 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2405.3620	3.7400	89.9605 (247)
Mechanical ventilation fans	66.2494	20.4300	13.5347 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	401.0095	20.4300	81.9262 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-491.9253	20.4300	-100.5003 (252)
Total energy cost			298.3532 (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	2756.9393	0.2160	595.4989 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2405.3620	0.2160	519.5582 (264)
Space and water heating			1115.0571 (265)
Pumps and fans	141.2494	0.5190	73.3084 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-491.9253	0.5190	-255.3093 (269)
Total kg/year			1141.1802 (272)

13a. Primary energy - Individual heating systems including micro-CHP

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2756.9393	1.2200	3363.4660 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2405.3620	1.2200	2934.5416 (264)
Space and water heating			6298.0076 (265)
Pumps and fans	141.2494	3.0700	433.6355 (267)
Energy for lighting	401.0095	3.0700	1231.0991 (268)
Energy saving/generation technologies			
PV Unit	-491.9253	3.0700	-1510.2108 (269)
Primary energy kWh/year			6452.5314 (272)
Primary energy kWh/m2/year			68.8637 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	+ 1.5	-£ 37	-248 kg (21.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£37	2.65 kg/m²	B 87 B 90
Total Savings	£37	2.65 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£111	£121	-£10
Mains gas	£288	£241	£47
Space heating	£227	£227	-£0
Water heating	£90	£52	£38
Lighting	£82	£82	£0
Generated (PV)	-£101	-£101	£0
Total cost of fuels	£298	£261	£37
Total cost of uses	£298	£260	£38
Delivered energy	56 kWh/m²	43 kWh/m²	13 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	3 kg/m²
Primary energy	69 kWh/m²	54 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.6830 (5)
Dwelling volume			

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																4.0500						
Number of sides sheltered																0.2025 (18)						
																1 (19)						
Shelter factor																(20) = 1 - [0.075 x (19)] =		0.9250 (20)				
Infiltration rate adjusted to include shelter factor																(21) = (18) x (20) =		0.1873 (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)										
	0.2388	0.2341	0.2295	0.2060	0.2014	0.1779	0.1779	0.1733	0.1873	0.2014	0.2107	0.2201 (22b)										
Mechanical extract ventilation - decentralised																						
If mechanical ventilation:																						
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)										

3. Heat losses and heat loss parameter

Element	Gross 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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4390		(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber FF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (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	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527	39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215	1.2215 (40)
HLP (average)												1.2215 (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 2.6731 (42)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Average daily hot water use (litres/day)												97.6851 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Water storage loss:												190.0000 (47)
Store volume												1.4400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7776 (55)
Enter (49) or (54) in (55)												24.1051 (56)
Total storage loss	24.1051	21.7724	24.1051	23.3275	24.1051	23.3275	24.1051	24.1051	23.3275	24.1051	23.3275	24.1051 (56)
If cylinder contains dedicated solar storage	14.5899	13.1780	14.5899	14.1193	14.5899	14.1193	14.5899	14.5899	14.1193	14.5899	14.1193	14.5899 (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	197.2029	173.5582	180.2729	155.2603	145.3656	127.8408	121.0264	136.1480	142.9389	166.6444	178.7415	192.1748 (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												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1800 (H8)
Utilisation factor												0.5715 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												97.6851 (H14)
Volume ratio Veff/V												1.1209 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-911.3654 (H17)
Solar input	-26.4278	-44.1004	-75.1080	-100.6595	-124.3563	-122.2621	-120.6463	-105.4093	-82.5566	-56.3765	-31.3472	-22.1155 (63)
Output from w/h	170.7751	129.4578	105.1649	54.6008	21.0093	5.5788	0.3801	30.7387	60.3823	110.2680	147.3944	170.0593 (64)
Heat gains from water heating, kWh/month	83.2659	73.6916	76.9842	65.5919	60.0487	53.7386	51.8472	57.3101	62.1265	72.4527	76.5567	81.5941 (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	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114 (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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222 (71)
Water heating gains (Table 5)	111.9166	109.6601	103.4734	91.0998	80.7106	74.6369	69.6870	77.0297	86.2868	97.3827	106.3287	109.6695 (72)
Total internal gains	645.6062	640.8083	615.6157	572.8641	528.8647	494.9543	475.4002	485.2842	513.5473	555.0212	597.5774	628.7549 (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			3.6600		19.6403		0.7200		0.7000		0.7700		25.1068 (76)
West			4.9500		19.6403		0.7200		0.7000		0.7700		33.9560 (80)
East			4.5200		19.6403		0.7200		0.7000		0.7700		31.0063 (76)
East			1.9700		26.6635		0.6300		0.7000		1.0000		20.8480 (82)
Solar gains	110.9171	218.6832	364.2982	537.7128	664.6035	682.8101	649.0492	553.7754	425.7886	260.5866	138.6088		91.0148 (83)
Total gains	756.5233	859.4915	979.9139	1110.5769	1193.4681	1177.7644	1124.4494	1039.0596	939.3359	815.6078	736.1862		719.7697 (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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9226	0.8970	0.8493	0.7666	0.6536	0.5205	0.4048	0.4468	0.6322	0.8119	0.8984	0.9300 (86)
MIT	18.5049	18.7963	19.2987	19.9029	20.4153	20.7543	20.9005	20.8720	20.5971	19.9141	19.0887	18.4225 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.9127	0.8842	0.8302	0.7366	0.6077	0.4527	0.3169	0.3573	0.5680	0.7804	0.8835	0.9210 (89)
MIT 2	16.6053	17.0211	17.7338	18.5742	19.2597	19.6808	19.8374	19.8135	19.5096	18.6136	17.4494	16.4877 (90)
Living area fraction									fLA = Living area / (4) =			0.0971 (91)
MIT	16.7898	17.1935	17.8858	18.7033	19.3719	19.7851	19.9406	19.9163	19.6152	18.7399	17.6086	16.6756 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6398	17.0435	17.7358	18.5533	19.2219	19.6351	19.7906	19.7663	19.4652	18.5899	17.4586	16.5256 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8707	0.8383	0.7820	0.6924	0.5755	0.4347	0.3073	0.3453	0.5389	0.7329	0.8373	0.8805	(94)
Useful gains	658.6809	720.4809	766.2563	768.9968	686.8122	512.0021	345.4992	358.7717	506.2045	597.7446	616.3773	633.7370	(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	1412.3720	1389.9025	1286.0069	1104.8778	860.9308	576.2973	365.1879	385.3001	614.0873	914.4919	1185.6056	1410.7453	(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	560.7462	449.8513	386.6944	241.8343	129.5442	0.0000	0.0000	0.0000	0.0000	235.6600	409.8444	578.0942	(98)
Space heating												2992.2691	(98)
Space heating per m2										(98) / (4) =		31.9346	(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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3310.0322 (211)
Space heating requirement	560.7462	449.8513	386.6944	241.8343	129.5442	0.0000	0.0000	0.0000	0.0000	235.6600	409.8444	578.0942	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	620.2944	497.6232	427.7593	267.5159	143.3012	0.0000	0.0000	0.0000	0.0000	260.6858	453.3677	639.4847	(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	170.7751	129.4578	105.1649	54.6008	21.0093	5.5788	0.3801	30.7387	60.3823	110.2680	147.3944	170.0593	(64)
Efficiency of water heater (217)m	87.6528	87.7669	87.8775	88.2185	88.7375	79.7000	79.7000	79.7000	79.7000	86.6901	87.2999	79.7000	(216)
Fuel for water heating, kWh/month	194.8313	147.5020	119.6722	61.8926	23.6757	6.9997	0.4769	38.5680	75.7620	127.1979	168.8368	193.8594	(219)
Water heating fuel used												1159.2746	(219)
Annual totals kWh/year													
Space heating fuel - main system												3310.0322	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													66.2494 (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													191.2494 (231)
Electricity for lighting (calculated in Appendix L)													401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 853 * 1.00) =										-436.7513		-436.7513	(233)
Total delivered energy for all uses												4624.8143	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3310.0322	3.4800	115.1891	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1159.2746	3.4800	40.3428	(247)
Mechanical ventilation fans	66.2494	13.1900	8.7383	(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	401.0095	13.1900	52.8931	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-436.7513	13.1900	-57.6075	(252)
Total energy cost			296.0433	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8965 (257)
SAP value		87.4945
SAP rating (Section 12)		87 (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	3310.0322	0.2160	714.9669 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1159.2746	0.2160	250.4033 (264)
Space and water heating			965.3703 (265)
Pumps and fans	191.2494	0.5190	99.2584 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-436.7513	0.5190	-226.6739 (269)
Total kg/year			1046.0787 (272)
CO2 emissions per m2			11.1600 (273)
EI value			89.8937
EI rating			90 (274)
EI band			B

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	40.7000 (1b)	x 2.6900 (2b)	= 109.4830 (1b) - (3b)
First floor	53.0000 (1c)	x 2.4000 (2c)	= 127.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 236.6830 (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												4.0500
Infiltration rate												0.2025 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)
Wind factor	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)
Adj infilt rate												
	0.2060	0.1920	0.1920	0.1826	0.1826	0.1733	0.1733	0.1639	0.1639	0.1779	0.1733	0.1826 (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 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)			8.6100	1.3258	11.4148		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.9700	1.6791	3.3078		(27a)
150mm EPS B&B			40.7000	0.1700	6.9190	75.0000	3052.5000 (28a)
140mm Timber Frame	103.8500	15.2500	88.6000	0.1900	16.8340	9.0000	797.4000 (29a)
Rooflight Stud Wall	5.4000		5.4000	0.3000	1.6200	9.0000	48.6000 (29a)
400mm Mineral Wool	59.6000		59.6000	0.1100	6.5560	9.0000	536.4000 (30)
Rooflight Sloping	2.1000	1.9700	0.1300	0.3000	0.0390	9.0000	1.1700 (30)
Total net area of external elements Aum(A, m ²)			211.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4390		(33)
Timebr Frame			37.1200	0.0000	0.0000	20.0000	742.4000 (32)
Timber GF			63.4300			9.0000	570.8700 (32c)
Timber PF			109.1500			9.0000	982.3500 (32c)
Internal Floor			31.1000			18.0000	559.8000 (32d)
Internal Ceiling			31.1000			18.0000	559.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7851.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.7918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9648 (36)
Total fabric heat loss						(33) + (36) =	75.4038 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.0527	Feb 39.0527	Mar 39.0527	Apr 39.0527	May 39.0527	Jun 39.0527	Jul 39.0527	Aug 39.0527	Sep 39.0527	Oct 39.0527	Nov 39.0527	Dec 39.0527 (38)
Heat transfer coeff	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565	114.4565 (39)
Average = Sum(39)m / 12 =												114.4565 (39)
HLP	Jan 1.2215	Feb 1.2215	Mar 1.2215	Apr 1.2215	May 1.2215	Jun 1.2215	Jul 1.2215	Aug 1.2215	Sep 1.2215	Oct 1.2215	Nov 1.2215	Dec 1.2215 (40)
HLP (average)												1.2215 (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	2.6731 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												97.6851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.4536	103.5462	99.6388	95.7314	91.8240	87.9165	87.9165	91.8240	95.7314	99.6388	103.5462	107.4536 (44)
Energy content (annual)	159.3505	139.3690	143.8163	125.3825	120.3075	103.8163	96.2010	110.3921	111.7105	130.1878	142.1102	154.3225 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9026	20.9053	21.5724	18.8074	18.0461	15.5724	14.4302	16.5588	16.7566	19.5282	21.3165	23.1484 (46)
Water storage loss:												190.0000 (47)
Store volume												1.4400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7776 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.1051	21.7724	24.1051	23.3275	24.1051	23.3275	24.1051	24.1051	23.3275	24.1051	23.3275	24.1051 (56)
If cylinder contains dedicated solar storage	14.5899	13.1780	14.5899	14.1193	14.5899	14.1193	14.5899	14.5899	14.1193	14.5899	14.1193	14.5899 (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	197.2029	173.5582	180.2729	155.2603	145.3656	127.8408	121.0264	136.1480	142.9389	166.6444	178.7415	192.1748 (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												1.3123 (H8)
Utilisation factor												0.5333 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												97.6851 (H14)
Volume ratio Veff/V												1.1209 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input	-31.0477	-44.1478	-75.8795	-102.3790	-119.6550	-129.0096	-122.8071	-111.9306	-87.4627	-60.1489	-36.7212	-945.7736 (H17)
Solar input	-31.0477	-44.1478	-75.8795	-102.3790	-119.6550	-129.0096	-122.8071	-111.9306	-87.4627	-60.1489	-36.7212	-24.5847 (63)
Solar input (sum of months) = Sum(63)m =												-945.7736 (63)
Output from w/h	166.1552	129.4104	104.3934	52.8813	25.7106	0.0000	0.0000	24.2174	55.4762	106.4956	142.0203	167.5902 (64)
Heat gains from water heating, kWh/month	83.2659	73.6916	76.9842	65.5919	60.0487	53.7386	51.8472	57.3101	62.1265	72.4527	76.5567	81.5941 (65)
Total per year (kWh/year) = Sum(64)m =												974.3505 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833	160.3833 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.7670	50.4200	41.0043	31.0429	23.2049	19.5906	21.1683	27.5154	36.9311	46.8925	54.7304	58.3448 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	366.7501	370.5558	360.9655	340.5489	314.7767	290.5544	274.3724	270.5667	280.1569	300.5735	326.3458	350.5681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114	53.7114 (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)	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222	-106.9222 (71)
Water heating gains (Table 5)	111.9166	109.6601	103.4734	91.0998	80.7106	74.6369	69.6870	77.0297	86.2868	97.3827	106.3287	109.6695 (72)
Total internal gains	645.6062	640.8083	615.6157	572.8641	528.8647	494.9543	475.4002	485.2842	513.5473	555.0212	597.5774	628.7549 (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			3.6600		25.1925		0.7200		0.7000		0.7700		32.2045 (76)
West			4.9500		25.1925		0.7200		0.7000		0.7700		43.5553 (80)
East			4.5200		25.1925		0.7200		0.7000		0.7700		39.7717 (76)
East			1.9700		34.6424		0.6300		0.7000		1.0000		27.0867 (82)
Solar gains	142.6182	239.2173	400.6577	592.3733	690.0394	776.2467	712.2715	635.8502	490.0971	303.4334	177.6478	110.7661	(83)
Total gains	788.2244	880.0257	1016.2734	1165.2374	1218.9041	1271.2010	1187.6717	1121.1344	1003.6443	858.4546	775.2253	739.5210	(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	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545	19.0545
alpha	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703	2.2703
util living area	0.9063	0.8809	0.8208	0.7206	0.5859	0.4132	0.3015	0.3174	0.5368	0.7547	0.8699	0.9152 (86)
MIT	18.7974	19.0402	19.5616	20.1378	20.6092	20.8797	20.9597	20.9552	20.7663	20.2140	19.4213	18.7437 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Th 2	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028	19.9028 (88)
util rest of house	0.8939	0.8654	0.7976	0.6846	0.5303	0.3368	0.2073	0.2190	0.4592	0.7122	0.8499	0.9036 (89)
MIT 2	17.0267	17.3707	18.1040	18.8920	19.5048	19.8127	19.8850	19.8828	19.7043	19.0202	17.9228	16.9519 (90)
Living area fraction	17.1987	17.5329	18.2455	19.0130	19.6121	19.9163	19.9894	19.9869	fLA = Living area / (4) =			0.0971 (91)
MIT	17.1987	17.5329	18.2455	19.0130	19.6121	19.9163	19.9894	19.9869	19.8074	19.1362	18.0683	17.1259 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0487	17.3829	18.0955	18.8630	19.4621	19.7663	19.8394	19.8369	19.6574	18.9862	17.9183	16.9759 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8490	0.8181	0.7499	0.6449	0.5057	0.3268	0.2016	0.2127	0.4400	0.6692	0.8016	0.8600	(94)
Useful gains	669.1761	719.9310	762.1300	751.4362	616.4242	415.3773	239.4414	238.5140	441.6524	574.4982	621.4070	635.9966	(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	1333.2708	1314.2874	1201.2801	1014.4268	728.1829	442.5211	244.8643	244.5865	498.7356	799.6115	1089.4359	1313.4900	(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	494.0865	399.4075	326.7277	189.3532	83.1484	0.0000	0.0000	0.0000	0.0000	167.4842	336.9808	504.0550	(98)
Space heating												2501.2434	(98)
Space heating per m2										(98) / (4) =		26.6942	(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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2766.8621 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	494.0865	399.4075	326.7277	189.3532	83.1484	0.0000	0.0000	0.0000	0.0000	167.4842	336.9808	504.0550	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	546.5558	441.8224	361.4244	209.4615	91.9783	0.0000	0.0000	0.0000	0.0000	185.2702	372.7664	557.5830	(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	166.1552	129.4104	104.3934	52.8813	25.7106	0.0000	0.0000	24.2174	55.4762	106.4956	142.0203	167.5902	(64)
Efficiency of water heater (217)m	87.4456	87.5245	87.5537	87.8260	87.6217	79.7000	79.7000	79.7000	79.7000	85.9165	86.9394	79.7000	(216)
Fuel for water heating, kWh/month	190.0099	147.8563	119.2336	60.2114	29.3427	0.0000	0.0000	30.3857	69.6063	123.9524	163.3556	191.5977	(219)
Water heating fuel used												1125.5514	(219)
Annual totals kWh/year													
Space heating fuel - main system												2766.8621	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													66.2494 (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													191.2494 (231)
Electricity for lighting (calculated in Appendix L)													401.0095 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 961 * 1.00) =									-491.9253				-491.9253 (233)
Total delivered energy for all uses													3992.7471 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2766.8621	3.7400	103.4806	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1125.5514	3.7400	42.0956	(247)
Mechanical ventilation fans	66.2494	20.4300	13.5347	(249)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	401.0095	20.4300	81.9262	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-491.9253	20.4300	-100.5003	(252)
Total energy cost			261.0744	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	2766.8621	0.2160	597.6422 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1125.5514	0.2160	243.1191 (264)
Space and water heating			840.7613 (265)
Pumps and fans	191.2494	0.5190	99.2584 (267)
Energy for lighting	401.0095	0.5190	208.1239 (268)
Energy saving/generation technologies			
PV Unit	-491.9253	0.5190	-255.3093 (269)
Total kg/year			892.8344 (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	2766.8621	1.2200	3375.5718 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1125.5514	1.2200	1373.1728 (264)
Space and water heating			4748.7445 (265)
Pumps and fans	191.2494	3.0700	587.1355 (267)
Energy for lighting	401.0095	3.0700	1231.0991 (268)
Energy saving/generation technologies			
PV Unit	-491.9253	3.0700	-1510.2108 (269)
Primary energy kWh/year			5056.7684 (272)
Primary energy kWh/m2/year			53.9676 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	83.8 (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	312.42 (P1)
Transmission heat loss coefficient	75.40 (37)
Summer heat loss coefficient	387.83 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	1.000	0.90	1.000	0.900 (P8)
East	1.000	1.00	1.000	1.000 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.6600	117.5071	0.7200	0.7000	0.9000	175.5742
West	4.9500	117.5071	0.7200	0.7000	0.9000	237.4569
East	4.5200	117.5071	0.7200	0.7000	0.9000	216.8293
East	1.9700	197.1775	0.6300	0.7000	1.0000	154.1717

total: 784.0320

	Jun	Jul	Aug	
Solar gains	833	784	686	(P3)
Internal gains	509	490	499	
Total summer gains	1343	1274	1184	(P5)

Summer gain/loss ratio	3.46	3.28	3.05	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 83.8)	1.41	1.41	1.41	
Threshold temperature	20.88	22.60	22.27	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

Assessment of likelihood of high internal temperature: Medium

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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