

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW021p_047_As_Built				Issued on Date	20/08/2020
Assessment Reference	001	Prop Type Ref	Sem Br Ea Ga			
Property						
SAP Rating	85 B	DER	15.94	TER	17.36	
Environmental	87 B	% DER<TER	8.16			
CO ₂ Emissions (t/year)	1.20	DFEE	42.37	TFEE	49.78	
General Requirements Compliance	Pass	% DFEE<TFEE	14.88			
Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk				Assessor ID	d168-0001
Client	Bellway Homes Thames Valley					

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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 93 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) 17.36 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.94 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)42.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.30 (max. 2.00)	1.30 (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:	4.15 (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 COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%		
Minimum	75%	OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power:	0.1600 0.1600	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing East: 7.25 m², No overhang

Windows facing South: 2.87 m², No overhang

Windows facing West: 3.59 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

Floor U-value 0.11 W/m²K

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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	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1764 (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	0.2249	0.2205	0.2161	0.1940	0.1896	0.1676	0.1676	0.1631	0.1764	0.1896	0.1984	0.2072 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m 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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss							(33) + (36) = 58.1673 (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	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211 (38)
Heat transfer coeff	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884 (39)
Average = Sum(39)m / 12 =												96.7884 (39)
HLP	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441 (40)
HLP (average)												1.0441 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)												Total = Sum(45)m = 1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (46)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1379	12.7588	14.0984	13.5992	14.0201	13.5306	13.9583	13.9984	13.5679	14.0660	13.6529	14.1258	14.1258	(61)
Total heat required for water heating calculated for each month	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	167.9924	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	167.9924	(64)
Heat gains from water heating, kWh/month	56.3620	49.3930	51.2023	44.9663	43.3891	37.7996	35.3819	40.0965	40.4260	46.6761	50.5252	54.6921	54.6921	(65)

5. Internal gains (see Table 5 and 5a)														
Metabolic gains (Table 5), Watts														
(66)m	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0593	20.4811	16.6563	12.6099	9.4261	7.9579	8.5988	11.1770	15.0018	19.0482	22.2320	23.7002	23.7002	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.9583	246.4898	240.1104	226.5295	209.3861	193.2737	182.5096	179.9781	186.3574	199.9383	217.0818	233.1942	233.1942	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	(71)
Water heating gains (Table 5)	75.7553	73.5014	68.8202	62.4532	58.3187	52.4994	47.5563	53.8932	56.1472	62.7367	70.1740	73.5109	73.5109	(72)
Total internal gains	408.6865	406.3859	391.5005	367.5062	343.0444	319.6445	304.5782	310.9618	323.4199	347.6367	375.4013	396.3188	396.3188	(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		7.2500	19.6403	0.4500	0.0000	0.7700	49.3388	(76)						
South		2.8700	46.7521	0.4500	0.0000	0.7700	46.4928	(78)						
West		3.5900	19.6403	0.4500	0.0000	0.7700	24.4312	(80)						
Solar gains	120.2628	220.4531	334.6507	456.2327	539.0171	544.7758	521.3993	459.9210	377.7264	253.3634	147.0924	100.8389	(83)	
Total gains	528.9493	626.8389	726.1512	823.7389	882.0615	864.4203	825.9776	770.8828	701.1463	601.0001	522.4937	497.1577	(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	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	
Feb	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	
Mar	0.9984	0.9957	0.9864	0.9511	0.8530	0.6790	0.5087	0.5648	0.8233	0.9746	0.9964	0.9989	0.9989	(86)
Apr	19.8758	20.0350	20.2901	20.5995	20.8474	20.9664	20.9941	20.9899	20.9064	20.5653	20.1480	19.8332	19.8332	(87)
May	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	(88)
Jun	0.9979	0.9943	0.9816	0.9337	0.8052	0.5930	0.4021	0.4543	0.7509	0.9624	0.9950	0.9985	0.9985	(89)
Jul	19.0176	19.1761	19.4286	19.7268	19.9459	20.0317	20.0452	20.0439	19.9961	19.6997	19.2893	18.9751	18.9751	(90)
Aug	0.9979	0.9943	0.9816	0.9337	0.8052	0.5930	0.4021	0.4543	0.7509	0.9624	0.9950	0.9985	0.9985	(91)
Sep	19.0176	19.1761	19.4286	19.7268	19.9459	20.0317	20.0452	20.0439	19.9961	19.6997	19.2893	18.9751	18.9751	(92)
Oct	0.9979	0.9943	0.9816	0.9337	0.8052	0.5930	0.4021	0.4543	0.7509	0.9624	0.9950	0.9985	0.9985	(93)
Nov	19.0176	19.1761	19.4286	19.7268	19.9459	20.0317	20.0452	20.0439	19.9961	19.6997	19.2893	18.9751	18.9751	(94)
Dec	0.9979	0.9943	0.9816	0.9337	0.8052	0.5930	0.4021	0.4543	0.7509	0.9624	0.9950	0.9985	0.9985	(95)
Temperature adjustment	19.1069	19.2656	19.5188	19.8202	20.0473	20.1423	20.1598	20.1577	20.0999	19.7911	19.3787	19.0644	19.0644	(96)

8. Space heating requirement														
Utilisation	0.9972	0.9927	0.9782	0.9287	0.8052	0.6021	0.4150	0.4676	0.7555	0.9581	0.9935	0.9980	0.9980	(94)
Useful gains	527.4639	622.2753	710.2997	765.0330	710.2728	520.4622	342.8095	360.4328	529.7338	575.8369	519.1103	496.1458	496.1458	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000	(96)
Heat loss rate W	1433.1360	1390.4283	1260.0724	1056.9445	807.9205	536.4321	344.5513	363.7000	580.7236	889.5906	1188.4399	1438.7020	1438.7020	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	673.8200	516.1988	409.0308	210.1763	72.6499	0.0000	0.0000	0.0000	0.0000	233.4328	481.9173	701.2618	701.2618	(98)
Space heating														(98)
Space heating per m2														(98) / (4) = 35.5824 (99)

8c. Space cooling requirement
Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3644.7378 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.8200	516.1988	409.0308	210.1763	72.6499	0.0000	0.0000	0.0000	0.0000	233.4328	481.9173	701.2618	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	744.5525	570.3854	451.9678	232.2390	80.2761	0.0000	0.0000	0.0000	0.0000	257.9368	532.5053	774.8749	(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	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	(64)
Efficiency of water heater (217)m	89.8273	89.7527	89.5871	89.2006	88.3990	87.3000	87.3000	87.3000	87.3000	89.2525	89.6985	87.3000	(216)
Fuel for water heating, kWh/month	192.6114	169.0378	175.7952	155.3927	151.5539	134.0665	125.8593	142.1126	143.1253	161.1935	173.1837	186.9419	(219)
Water heating fuel used												1910.8739	(219)
Annual totals kWh/year													
Space heating fuel - main system												3644.7378	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.8080, total flow = 37.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													52.5435 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													127.5435 (231)
Electricity for lighting (calculated in Appendix L)													407.2350 (232)
Total delivered energy for all uses													6090.3901 (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	3644.7378	0.2160	787.2634	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1910.8739	0.2160	412.7488	(264)
Space and water heating			1200.0121	(265)
Pumps and fans	127.5435	0.5190	66.1951	(267)
Energy for lighting	407.2350	0.5190	211.3549	(268)
Total CO2, kg/year			1477.5621	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9400	(273)

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

DER			15.9400	ZC1
Total Floor Area		TFA	92.7000	
Assumed number of occupants		N	2.6609	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5949	ZC2
CO2 emissions from cooking, equation (L16)			1.9726	ZC3
Total CO2 emissions			33.5075	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			33.5075	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3214 (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	0.4098	0.4018	0.3938	0.3536	0.3456	0.3054	0.3054	0.2973	0.3214	0.3456	0.3616	0.3777 (22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9700	1.2000	2.3640		(26a)
TER Opening Type (Uw = 1.40)			13.7100	1.3258	18.1761		(27)
Rackhams White/Grey 150TS			46.3500	0.1300	6.0255		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1800	14.1210		(29a)
Plane Roof	46.3500		46.3500	0.1300	6.0255		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7121		(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)							9.9639 (36)
Total fabric heat loss						(33) + (36) =	56.6760 (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	45.1083	44.8564	44.6095	43.4497	43.2327	42.2226	42.2226	42.0356	42.6117	43.2327	43.6717	44.1306 (38)
Heat transfer coeff	101.7843	101.5324	101.2855	100.1257	99.9088	98.8986	98.8986	98.7116	99.2877	99.9088	100.3477	100.8066 (39)
Average = Sum(39)m / 12 =												100.1247 (39)
HLP	1.0980	1.0953	1.0926	1.0801	1.0778	1.0669	1.0669	1.0648	1.0711	1.0778	1.0825	1.0875 (40)
HLP (average)												1.0801 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)										Total = Sum(45)m =		1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.6248	47.0705	46.6542	43.2280	44.6689	46.6542	47.0705	50.6248	49.3151	50.9589 (61)
Solar input	209.8386	184.9846	194.0162	172.0826	166.6063	146.7375	140.5857	156.7201	158.4510	180.4280	191.0054	204.8254 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	209.8386	184.9846	194.0162	172.0826	166.6063	146.7375	140.5857	156.7201	158.4510	180.4280	191.0054	204.8254 (64)
	65.5672	57.7101	60.3338	53.3341	51.5476	45.2239	43.0596	48.2605	48.8016	55.8158	59.4408	63.9003 (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	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0593	20.4811	16.6563	12.6099	9.4261	7.9579	8.5988	11.1770	15.0018	19.0482	22.2320	23.7002	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.9583	246.4898	240.1104	226.5295	209.3861	193.2737	182.5096	179.9781	186.3574	199.9383	217.0818	233.1942	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	(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)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	(71)
Water heating gains (Table 5)	88.1280	85.8782	81.0939	74.0752	69.2844	62.8110	57.8758	64.8662	67.7800	75.0212	82.5567	85.8876	(72)
Total internal gains	421.0591	418.7626	403.7742	379.1282	354.0101	329.9561	314.8977	321.9348	335.0528	359.9212	387.7840	408.6955	(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												7.2500	19.6403	0.6300	0.7000	0.7700	43.5168 (76)
South												2.8700	46.7521	0.6300	0.7000	0.7700	41.0067 (78)
West												3.5900	19.6403	0.6300	0.7000	0.7700	21.5483 (80)
Solar gains	106.0718	194.4396	295.1619	402.3972	475.4131	480.4922	459.8742	405.6504	333.1546	223.4665	129.7355	88.9400 (83)					
Total gains	527.1309	613.2022	698.9361	781.5254	829.4232	810.4483	774.7719	727.5852	668.2074	583.3877	517.5195	497.6354 (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	63.2465	63.4034	63.5580	64.2942	64.4338	65.0919	65.0919	65.2152	64.8368	64.4338	64.1519	63.8599	
alpha	5.2164	5.2269	5.2372	5.2863	5.2956	5.3395	5.3395	5.3477	5.3225	5.2956	5.2768	5.2573	
util living area	0.9985	0.9963	0.9892	0.9627	0.8848	0.7232	0.5500	0.6042	0.8521	0.9788	0.9966	0.9989	(86)
MIT	19.7998	19.9524	20.2042	20.5288	20.7995	20.9519	20.9907	20.9851	20.8811	20.5195	20.0983	19.7739	(87)
Th 2	20.0025	20.0047	20.0069	20.0171	20.0190	20.0280	20.0280	20.0296	20.0245	20.0190	20.0152	20.0111	(88)
util rest of house	0.9979	0.9950	0.9853	0.9485	0.8420	0.6356	0.4346	0.4867	0.7837	0.9682	0.9953	0.9985	(89)
MIT 2	18.3962	18.6206	18.9881	19.4582	19.8194	19.9953	20.0245	20.0234	19.9273	19.4534	18.8419	18.3646	(90)
Living area fraction									fLA = Living area / (4) =			0.2789	(91)
MIT	18.7876	18.9920	19.3272	19.7568	20.0927	20.2620	20.2939	20.2916	20.1933	19.7507	19.1923	18.7576	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7876	18.9920	19.3272	19.7568	20.0927	20.2620	20.2939	20.2916	20.1933	19.7507	19.1923	18.7576	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9970	0.9931	0.9816	0.9438	0.8457	0.6581	0.4670	0.5196	0.7972	0.9644	0.9936	0.9978	(94)
Ext temp.	525.5459	609.0004	686.1062	737.6214	701.4467	533.3791	361.8083	378.0799	532.7044	562.5991	514.1955	496.5177	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1474.6120	1430.7909	1299.2085	1087.0426	838.5080	559.9689	365.3248	384.1425	604.9903	914.2320	1213.4322	1467.4986	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	706.1052	552.2432	456.1481	251.5832	101.9736	0.0000	0.0000	0.0000	0.0000	261.6149	503.4504	722.4098	(98)
Space heating per m2												355.5284	(98)
												38.3552	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3806.7756 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	706.1052	552.2432	456.1481	251.5832	101.9736	0.0000	0.0000	0.0000	0.0000	261.6149	503.4504	722.4098	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	756.0013	591.2668	488.3812	269.3610	109.1794	0.0000	0.0000	0.0000	0.0000	280.1016	539.0262	773.4580	(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	209.8386	184.9846	194.0162	172.0826	166.6063	146.7375	140.5857	156.7201	158.4510	180.4280	191.0054	204.8254	(64)
Efficiency of water heater (217)m	87.8681	87.6342	87.1297	86.0061	83.8572	80.3000	80.3000	80.3000	80.3000	85.9856	87.3772	80.3000	(216)
Fuel for water heating, kWh/month	238.8110	211.0871	222.6751	200.0818	198.6786	182.7367	175.0756	195.1683	197.3237	209.8351	218.5986	232.8721	(219)
Water heating fuel used												2482.9438	(219)
Annual totals kWh/year													
Space heating fuel - main system												3806.7756	(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)												407.2350	(232)
Total delivered energy for all uses												6771.9544	(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	3806.7756	0.2160	822.2635 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.9438	0.2160	536.3159 (264)
Space and water heating			1358.5794 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.2350	0.5190	211.3549 (268)
Total CO2, kg/m2/year			1608.8593 (272)
Emissions per m2 for space and water heating			14.6557 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2800 (272b)
Emissions per m2 for pumps and fans			0.4199 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6557 * 1.00) + 2.2800 + 0.4199, rounded to 2 d.p.			17.3600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2853 (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	0.3638	0.3566	0.3495	0.3138	0.3067	0.2711	0.2711	0.2639	0.2853	0.3067	0.3210	0.3352 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5470	0.5367	0.5367	0.5348	0.5407	0.5470	0.5515	0.5562 (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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss						(33) + (36) =	58.1673 (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	43.7321	43.5336	43.3391	42.4254	42.2544	41.4586	41.4586	41.3112	41.7651	42.2544	42.6003	42.9618 (38)
Heat transfer coeff	101.8994	101.7009	101.5064	100.5927	100.4217	99.6259	99.6259	99.4785	99.9324	100.4217	100.7676	101.1291 (39)
Average = Sum(39)m / 12 =												100.5919 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0992	1.0971	1.0950	1.0851	1.0833	1.0747	1.0747	1.0731	1.0780	1.0833	1.0870	1.0909 (40)
HLP (average)												1.0851 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)										Total = Sum(45)m =		1532.4252 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	33.7619	29.5284	30.4707	26.5651	25.4898	21.9958	20.3823	23.3890	23.6683	27.5832	30.1092	32.6966 (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	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0593	20.4811	16.6563	12.6099	9.4261	7.9579	8.5988	11.1770	15.0018	19.0482	22.2320	23.7002	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.9583	246.4898	240.1104	226.5295	209.3861	193.2737	182.5096	179.9781	186.3574	199.9383	217.0818	233.1942	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	(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)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	(71)
Water heating gains (Table 5)	45.3790	43.9411	40.9552	36.8959	34.2605	30.5497	27.3956	31.4368	32.8727	37.0742	41.8183	43.9471	(72)
Total internal gains	375.3101	373.8255	360.6355	338.9489	315.9862	294.6948	281.4175	285.5054	297.1454	318.9742	344.0457	363.7550	(73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
					W/m2								
East				7.2500	19.6403		0.4500		0.0000		0.7700		49.3388 (76)
South				2.8700	46.7521		0.4500		0.0000		0.7700		46.4928 (78)
West				3.5900	19.6403		0.4500		0.0000		0.7700		24.4312 (80)

Solar gains	120.2628	220.4531	334.6507	456.2327	539.0171	544.7758	521.3993	459.9210	377.7264	253.3634	147.0924	100.8389	(83)
Total gains	495.5729	594.2786	695.2862	795.1816	855.0033	839.4706	802.8168	745.4265	674.8718	572.3376	491.1380	464.5940	(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	63.1750	63.2983	63.4196	63.9957	64.1047	64.6167	64.6167	64.7125	64.4185	64.1047	63.8846	63.6562		
alpha	5.2117	5.2199	5.2280	5.2664	5.2736	5.3078	5.3078	5.3142	5.2946	5.2736	5.2590	5.2437		
util living area	0.9989	0.9968	0.9894	0.9604	0.8753	0.7080	0.5358	0.5953	0.8500	0.9806	0.9974	0.9992	(86)	
MIT	19.7660	19.9310	20.1978	20.5351	20.8097	20.9556	20.9916	20.9858	20.8810	20.5045	20.0665	19.7354	(87)	
Th 2	20.0015	20.0032	20.0049	20.0130	20.0145	20.0215	20.0215	20.0228	20.0188	20.0145	20.0114	20.0082	(88)	
util rest of house	0.9985	0.9957	0.9856	0.9455	0.8305	0.6199	0.4220	0.4782	0.7809	0.9708	0.9963	0.9989	(89)	
MIT 2	18.8714	19.0372	19.3034	19.6377	19.8864	20.0012	20.0194	20.0188	19.9527	19.6147	19.1795	18.8463	(90)	
Living area fraction	19.1208	19.2864	19.5528	19.8880	20.1439	20.2674	20.2905	20.2884	20.2115	19.8628	19.4269	19.0942	(91)	
MIT	19.1208	19.2864	19.5528	19.8880	20.1439	20.2674	20.2905	20.2884	20.2115	19.8628	19.4269	19.0942	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.1208	19.2864	19.5528	19.8880	20.1439	20.2674	20.2905	20.2884	20.2115	19.8628	19.4269	19.0942	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9946	0.9834	0.9433	0.8371	0.6434	0.4540	0.5112	0.7963	0.9688	0.9954	0.9985	(94)
Useful gains	494.5713	591.0666	683.7259	750.0665	715.7228	540.0858	364.4885	381.0256	537.4336	554.4888	488.8746	463.9201	(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	1510.2352	1463.1144	1324.9397	1105.3102	847.9472	564.6159	367.6687	386.8154	610.7416	930.1902	1242.1475	1506.2402	(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	755.6539	586.0162	477.0630	255.7754	98.3749	0.0000	0.0000	0.0000	0.0000	279.5218	542.3565	775.4861	(98)
Space heating												3770.2479	(98)
Space heating per m2											(98) / (4) =	40.6715	(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	936.4834	737.2316	756.0368	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8957	0.9466	0.9266	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	838.7648	697.8837	700.5553	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1082.5078	1037.5670	972.4178	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	175.4950	252.7244	202.2657	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												630.4852 (104)
Cooled Fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	43.8738	63.1811	50.5664	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												157.6213 (107)
Space cooling per m2												1.7003 (108)
Energy for space heating												40.6715 (99)
Energy for space cooling												1.7003 (108)
Total												42.3718 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 234.0675 (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) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3214 (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	0.4098	0.4018	0.3938	0.3536	0.3456	0.3054	0.3054	0.2973	0.3214	0.3456	0.3616	0.3777 (22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9700	1.2000	2.3640		(26a)
TER Opening Type (Uw = 1.40)			13.7100	1.3258	18.1761		(27)
Rackhams White/Grey 150TS			46.3500	0.1300	6.0255		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1800	14.1210		(29a)
Plane Roof	46.3500		46.3500	0.1300	6.0255		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7121		(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)							9.9639 (36)
Total fabric heat loss						(33) + (36) =	56.6760 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.1083	44.8564	44.6095	43.4497	43.2327	42.2226	42.2226	42.0356	42.6117	43.2327	43.6717	44.1306 (38)
Heat transfer coeff	101.7843	101.5324	101.2855	100.1257	99.9088	98.8986	98.8986	98.7116	99.2877	99.9088	100.3477	100.8066 (39)
Average = Sum(39)m / 12 =												100.1247 (39)
HLP	1.0980	1.0953	1.0926	1.0801	1.0778	1.0669	1.0669	1.0648	1.0711	1.0778	1.0825	1.0875 (40)
HLP (average)												1.0801 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)										Total = Sum(45)m =		1532.4252 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	33.7619	29.5284	30.4707	26.5651	25.4898	21.9958	20.3823	23.3890	23.6683	27.5832	30.1092	32.6966 (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	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	133.0451	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0593	20.4811	16.6563	12.6099	9.4261	7.9579	8.5988	11.1770	15.0018	19.0482	22.2320	23.7002	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.9583	246.4898	240.1104	226.5295	209.3861	193.2737	182.5096	179.9781	186.3574	199.9383	217.0818	233.1942	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	36.3045	(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)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	(71)
Water heating gains (Table 5)	45.3790	43.9411	40.9552	36.8959	34.2605	30.5497	27.3956	31.4368	32.8727	37.0742	41.8183	43.9471	(72)
Total internal gains	375.3101	373.8255	360.6355	338.9489	315.9862	294.6948	281.4175	285.5054	297.1454	318.9742	344.0457	363.7550	(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				7.2500	19.6403	0.6300	0.7000	0.7700	43.5168 (76)			
South				2.8700	46.7521	0.6300	0.7000	0.7700	41.0067 (78)			
West				3.5900	19.6403	0.6300	0.7000	0.7700	21.5483 (80)			
Solar gains	106.0718	194.4396	295.1619	402.3972	475.4131	480.4922	459.8742	405.6504	333.1546	223.4665	129.7355	88.9400 (83)
Total gains	481.3819	568.2651	655.7974	741.3462	791.3993	775.1870	741.2917	691.1558	630.3001	542.4407	473.7811	452.6950 (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	63.2465	63.4034	63.5580	64.2942	64.4338	65.0919	65.0919	65.2152	64.8368	64.4338	64.1519	63.8599	
alpha	5.2164	5.2269	5.2372	5.2863	5.2956	5.3395	5.3395	5.3477	5.3225	5.2956	5.2768	5.2573	
util living area	0.9990	0.9974	0.9918	0.9697	0.9003	0.7463	0.5724	0.6314	0.8747	0.9844	0.9978	0.9993	(86)
MIT	19.7533	19.9072	20.1623	20.4945	20.7776	20.9440	20.9889	20.9818	20.8625	20.4815	20.0542	19.7280	(87)
Th 2	20.0025	20.0047	20.0069	20.0171	20.0190	20.0280	20.0280	20.0296	20.0245	20.0190	20.0152	20.0111	(88)
util rest of house	0.9987	0.9965	0.9888	0.9578	0.8610	0.6593	0.4535	0.5108	0.8114	0.9764	0.9969	0.9990	(89)
MIT 2	18.8595	19.0148	19.2701	19.6035	19.8653	20.0015	20.0251	20.0243	19.9456	19.5967	19.1702	18.8412	(90)
Living area fraction									fLA = Living area / (4) =			0.2789	(91)
MIT	19.1087	19.2636	19.5189	19.8519	20.1197	20.2644	20.2938	20.2913	20.2013	19.8434	19.4167	19.0885	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1087	19.2636	19.5189	19.8519	20.1197	20.2644	20.2938	20.2913	20.2013	19.8434	19.4167	19.0885	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9956	0.9869	0.9553	0.8657	0.6821	0.4870	0.5448	0.8247	0.9745	0.9961	0.9987	(94)
Ext temp.	480.5309	565.7422	647.1888	708.1960	685.0882	528.7632	361.0303	376.5570	519.7880	528.5827	471.9221	452.1149	(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	1507.2947	1458.3754	1318.6287	1096.5707	841.2029	560.1976	365.3140	384.1142	605.7809	923.4965	1235.9561	1500.8591	(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	763.9123	599.8495	499.5513	279.6298	116.1494	0.0000	0.0000	0.0000	0.0000	293.8159	550.1045	780.2657	(98)
Space heating												3883.2783	(98)
Space heating per m2										(98) / (4) =		41.8908	(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	929.6473	731.8500	750.2081	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8740	0.9334	0.9112	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	812.5338	683.1192	683.5650	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1007.3712	965.6546	908.9845	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	140.2830	210.2063	167.7121	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												518.2014	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.0707	52.5516	41.9280	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.5504 (107)
Space cooling per m2												1.3975 (108)
Energy for space heating												41.8908 (99)
Energy for space cooling												1.3975 (108)
Total												43.2883 (109)
Target Fabric Energy Efficiency (TFEE)												49.8 (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	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1852	0.1764	0.1764	0.1631	0.1631	0.1455	0.1499	0.1411	0.1455	0.1543	0.1543	0.1676 (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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss						(33) + (36) =	58.1673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211 (38)
Heat transfer coeff	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884 (39)
Average = Sum(39)m / 12 =												96.7884 (39)
HLP	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441 (40)
HLP (average)												1.0441 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)										Total = Sum(45)m =		1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1379	12.7588	14.0984	13.5992	14.0201	13.5306	13.9583	13.9984	13.5679	14.0660	13.6529	14.1258	14.1258	(61)
Total heat required for water heating calculated for each month	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	167.9924	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	167.9924	(64)
RHI water heating demand	56.3620	49.3930	51.2023	44.9663	43.3891	37.7996	35.3819	40.0965	40.4260	46.6761	50.5252	54.6921	54.6921	(65)
Heat gains from water heating, kWh/month														
	56.3620	49.3930	51.2023	44.9663	43.3891	37.7996	35.3819	40.0965	40.4260	46.6761	50.5252	54.6921	54.6921	(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	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.6483	51.2027	41.6409	31.5248	23.5652	19.8947	21.4969	27.9425	37.5044	47.6204	55.5801	59.2505	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.1168	367.8952	358.3738	338.1038	312.5165	288.4682	272.4024	268.6240	278.1454	298.4154	324.0026	348.0510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	(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)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	(71)
Water heating gains (Table 5)	75.7553	73.5014	68.8202	62.4532	58.3187	52.4994	47.5563	53.8932	56.1472	62.7367	70.1740	73.5109	(72)
Total internal gains	607.3648	602.4437	578.6792	541.9262	504.2448	470.7066	451.3000	460.3040	481.6414	518.6169	559.6010	590.6568	(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					7.2500	22.3313	0.4500	0.0000			0.7700			56.0991 (76)
South					2.8700	50.9848	0.4500	0.0000			0.7700			50.7021 (78)
West					3.5900	22.3313	0.4500	0.0000			0.7700			27.7787 (80)
Solar gains	134.5799	222.1157	333.2850	468.6112	539.8432	584.1845	552.9474	498.3879	407.8778	272.6279	168.6620	111.7338	(83)	
Total gains	741.9447	824.5595	911.9643	1010.5374	1044.0880	1054.8911	1004.2474	958.6920	889.5192	791.2447	728.2630	702.3906	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	
alpha	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	
util living area	0.9901	0.9817	0.9538	0.8692	0.6974	0.4551	0.2985	0.3226	0.6110	0.8971	0.9778	0.9923	(86)
MIT	20.1691	20.2964	20.5388	20.7976	20.9523	20.9961	20.9997	20.9995	20.9815	20.7934	20.4358	20.1302	(87)
Th 2	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	(88)
util rest of house	0.9869	0.9759	0.9394	0.8323	0.6293	0.3702	0.2069	0.2268	0.5195	0.8580	0.9694	0.9898	(89)
MIT 2	19.3087	19.4336	19.6672	19.9010	20.0209	20.0456	20.0467	20.0467	20.0395	19.9035	19.5716	19.2704	(90)
Living area fraction	19.5486	19.6742	19.9103	20.1510	20.2806	20.3106	20.3125	20.3124	20.3022	20.1517	19.8125	19.5102	(92)
Temperature adjustment	19.3986	19.5242	19.7603	20.0010	20.1306	20.1606	20.1625	20.1624	20.1522	20.0017	19.6625	-0.1500	
adjusted MIT												19.3602	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9840	0.9719	0.9341	0.8303	0.6356	0.3805	0.2180	0.2384	0.5301	0.8559	0.9651	0.9873	(94)
Ext temp.	730.1014	801.4079	851.8865	839.0263	663.6457	401.3683	218.9359	228.5803	471.4931	677.2187	702.8678	693.4941	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1383.9395	1347.6992	1196.3299	977.6633	690.1636	402.6999	218.9795	228.6525	479.3175	813.1849	1128.7998	1380.2217	(97)
Space heating kWh	486.4555	367.1078	256.2659	99.8187	19.7293	0.0000	0.0000	0.0000	0.0000	101.1589	306.6711	510.9253	(98)
RHI space heating demand												2148.1325	(98)
												2148	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (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	0.2249	0.2205	0.2161	0.1940	0.1896	0.1676	0.1676	0.1631	0.1764	0.1896	0.1984	0.2072 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m 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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss						(33) + (36) =	58.1673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211 (38)
Heat transfer coeff	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884 (39)
Average = Sum(39)m / 12 =												96.7884 (39)
HLP	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441 (40)
HLP (average)												1.0441 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)										Total = Sum(45)m =		1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (46)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.12R02



Southern Energy Consultants
Energy & Sustainability Solutions

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 (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 (57)
Combi loss	14.1379	12.7588	14.0984	13.5992	14.0201	13.5306	13.9583	13.9984	13.5679	14.0660	13.6529 (61)
Total heat required for water heating calculated for each month											
	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432 (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 =										0.0000 (63)
Output from w/h											
	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432 (64)
	Total per year (kWh/year) = Sum(64)m =										1697.9396 (64)
Heat gains from water heating, kWh/month											
	56.3620	49.3930	51.2023	44.9663	43.3891	37.7996	35.3819	40.0965	40.4260	46.6761	50.5252 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.6483	51.2027	41.6409	31.5248	23.5652	19.8947	21.4969	27.9425	37.5044	47.6204	55.5801	59.2505 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.1168	367.8952	358.3738	338.1038	312.5165	288.4682	272.4024	268.6240	278.1454	298.4154	324.0026	348.0510 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263 (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)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361 (71)
Water heating gains (Table 5)	75.7553	73.5014	68.8202	62.4532	58.3187	52.4994	47.5563	53.8932	56.1472	62.7367	70.1740	73.5109 (72)
Total internal gains	607.3648	602.4437	578.6792	541.9262	504.2448	470.7066	451.3000	460.3040	481.6414	518.6169	559.6010	590.6568 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				7.2500	19.6403	0.4500	0.0000	0.7700	49.3388 (76)			
South				2.8700	46.7521	0.4500	0.0000	0.7700	46.4928 (78)			
West				3.5900	19.6403	0.4500	0.0000	0.7700	24.4312 (80)			
Solar gains	120.2628	220.4531	334.6507	456.2327	539.0171	544.7758	521.3993	459.9210	377.7264	253.3634	147.0924	100.8389 (83)
Total gains	727.6277	822.8968	913.3299	998.1589	1043.2619	1015.4824	972.6993	920.2251	859.3677	771.9802	706.6934	691.4957 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110
alpha	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341
util living area												
	0.9928	0.9851	0.9639	0.9035	0.7762	0.5931	0.4350	0.4789	0.7223	0.9327	0.9854	0.9945 (86)
MIT	20.0765	20.2276	20.4596	20.7218	20.9067	20.9823	20.9972	20.9954	20.9513	20.7039	20.3296	20.0306 (87)
Th 2	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467 (88)
util rest of house												
	0.9905	0.9805	0.9529	0.8754	0.7204	0.5120	0.3423	0.3823	0.6427	0.9064	0.9801	0.9927 (89)
MIT 2	19.2168	19.3658	19.5913	19.8349	19.9886	20.0392	20.0461	20.0455	20.0227	19.8251	19.4678	19.1714 (90)
Living area fraction									fLA = Living area / (4) =			0.2789 (91)
MIT	19.4565	19.6061	19.8334	20.0822	20.2446	20.3022	20.3113	20.3104	20.2816	20.0702	19.7081	19.4110 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3065	19.4561	19.6834	19.9322	20.0946	20.1522	20.1613	20.1604	20.1316	19.9202	19.5581	19.2610 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9882	0.9769	0.9477	0.8716	0.7234	0.5212	0.3536	0.3940	0.6503	0.9022	0.9765	0.9908 (94)
Useful gains	719.0399	803.8755	865.5953	869.9792	754.7399	529.2858	343.8987	362.5342	558.8178	696.5133	690.1207	685.1272 (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	1452.4591	1408.8629	1276.0036	1067.7937	812.5011	537.3866	344.6924	363.9615	583.7928	902.0828	1205.7984	1457.7320 (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	545.6639	406.5516	305.3438	142.4264	42.9743	0.0000	0.0000	0.0000	0.0000	152.9437	371.2879	574.8179 (98)
Space heating												2542.0095 (98)
Space heating per m2												27.4219 (99)
										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2808.8503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	545.6639	406.5516	305.3438	142.4264	42.9743	0.0000	0.0000	0.0000	0.0000	152.9437	371.2879	574.8179	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	602.9435	449.2282	337.3964	157.3773	47.4854	0.0000	0.0000	0.0000	0.0000	168.9986	410.2629	635.1579	(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	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	(64)
Efficiency of water heater (217)m	89.7084	89.6074	89.3851	88.8929	88.0562	87.3000	87.3000	87.3000	87.3000	88.9201	89.5319	87.3000	(216)
Fuel for water heating, kWh/month	192.8667	169.3119	176.1925	155.9306	152.1440	134.0665	125.8593	142.1126	143.1253	161.7960	173.5059	187.1657	(219)
Water heating fuel used													1914.0771 (219)
Annual totals kWh/year													
Space heating fuel - main system													2808.8503 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.8080, total flow = 37.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													52.5435 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													127.5435 (231)
Electricity for lighting (calculated in Appendix L)													407.2350 (232)
Total delivered energy for all uses													5257.7058 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2808.8503	3.4800	97.7480 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1914.0771	3.4800	66.6099 (247)
Mechanical ventilation fans	52.5435	13.1900	6.9305 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	407.2350	13.1900	53.7143 (250)
Additional standing charges			120.0000 (251)
Total energy cost			354.8951 (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] =	1.0825 (257)
SAP value		84.8996
SAP rating (Section 12)		85 (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	2808.8503	0.2160	606.7117 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1914.0771	0.2160	413.4407 (264)
Space and water heating			1020.1523 (265)
Pumps and fans	127.5435	0.5190	66.1951 (267)
Energy for lighting	407.2350	0.5190	211.3549 (268)
Total kg/year			1297.7023 (272)
CO2 emissions per m2			14.0000 (273)
EI value			87.3717
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8859 = 3.928$, stars = 4
Water heating environmental impact	$0.216 / 0.8859 = 0.2438$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1852	0.1764	0.1764	0.1631	0.1631	0.1455	0.1499	0.1411	0.1455	0.1543	0.1543	0.1676 (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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss						(33) + (36) =	58.1673 (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	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211 (38)
Heat transfer coeff	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884 (39)
Average = Sum(39)m / 12 =												96.7884 (39)
HLP	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441 (40)
HLP (average)												1.0441 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)												Total = Sum(45)m = 1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1379	12.7588	14.0984	13.5992	14.0201	13.5306	13.9583	13.9984	13.5679	14.0660	13.6529	14.1258	(61)
Total heat required for water heating calculated for each month	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	(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	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	(64)
Heat gains from water heating, kWh/month	56.3620	49.3930	51.2023	44.9663	43.3891	37.7996	35.3819	40.0965	40.4260	46.6761	50.5252	54.6921	(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	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	159.6542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.6483	51.2027	41.6409	31.5248	23.5652	19.8947	21.4969	27.9425	37.5044	47.6204	55.5801	59.2505	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.1168	367.8952	358.3738	338.1038	312.5165	288.4682	272.4024	268.6240	278.1454	298.4154	324.0026	348.0510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	53.6263	(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)	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	-106.4361	(71)
Water heating gains (Table 5)	75.7553	73.5014	68.8202	62.4532	58.3187	52.4994	47.5563	53.8932	56.1472	62.7367	70.1740	73.5109	(72)
Total internal gains	607.3648	602.4437	578.6792	541.9262	504.2448	470.7066	451.3000	460.3040	481.6414	518.6169	559.6010	590.6568	(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			7.2500	22.3313		0.4500		0.0000		0.7700		56.0991 (76)	
South			2.8700	50.9848		0.4500		0.0000		0.7700		50.7021 (78)	
West			3.5900	22.3313		0.4500		0.0000		0.7700		27.7787 (80)	

Solar gains	134.5799	222.1157	333.2850	468.6112	539.8432	584.1845	552.9474	498.3879	407.8778	272.6279	168.6620	111.7338	(83)
Total gains	741.9447	824.5595	911.9643	1010.5374	1044.0880	1054.8911	1004.2474	958.6920	889.5192	791.2447	728.2630	702.3906	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110	66.5110		
alpha	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341	5.4341		
util living area	0.9901	0.9817	0.9538	0.8692	0.6974	0.4551	0.2985	0.3226	0.6110	0.8971	0.9778	0.9923	(86)	
MIT	20.1691	20.2964	20.5388	20.7976	20.9523	20.9961	20.9997	20.9995	20.9815	20.7934	20.4358	20.1302	(87)	
Th 2	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	20.0467	(88)	
util rest of house	0.9869	0.9759	0.9394	0.8323	0.6293	0.3702	0.2069	0.2268	0.5195	0.8580	0.9694	0.9898	(89)	
MIT 2	19.3087	19.4336	19.6672	19.9010	20.0209	20.0456	20.0467	20.0467	20.0395	19.9035	19.5716	19.2704	(90)	
Living area fraction									fLA = Living area / (4) =			0.2789	(91)	
MIT	19.5486	19.6742	19.9103	20.1510	20.2806	20.3106	20.3125	20.3124	20.3022	20.1517	19.8125	19.5102	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.3986	19.5242	19.7603	20.0010	20.1306	20.1606	20.1625	20.1624	20.1522	20.0017	19.6625	19.3602	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9840	0.9719	0.9341	0.8303	0.6356	0.3805	0.2180	0.2384	0.5301	0.8559	0.9651	0.9873	(94)
Ext temp.	730.1014	801.4079	851.8865	839.0263	663.6457	401.3683	218.9359	228.5803	471.4931	677.2187	702.8678	693.4941	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1383.9395	1347.6992	1196.3299	977.6633	690.1636	402.6999	218.9795	228.6525	479.3175	813.1849	1128.7998	1380.2217	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	486.4555	367.1078	256.2659	99.8187	19.7293	0.0000	0.0000	0.0000	0.0000	101.1589	306.6711	510.9253	(98)
Space heating per m2												2148.1325	(98)
										(98) / (4) =		23.1730	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2373.6270 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	486.4555	367.1078	256.2659	99.8187	19.7293	0.0000	0.0000	0.0000	0.0000	101.1589	306.6711	510.9253	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	537.5199	405.6440	283.1667	110.2969	21.8004	0.0000	0.0000	0.0000	0.0000	111.7778	338.8631	564.5583	(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	173.0176	151.7160	157.4898	138.6113	133.9722	117.0401	109.8751	124.0643	124.9484	143.8692	155.3432	167.9924	(64)
Efficiency of water heater (217)m	89.6380	89.5402	89.2547	88.6117	87.6980	87.3000	87.3000	87.3000	87.3000	88.5933	89.3982	87.3000	(216)
Fuel for water heating, kWh/month	193.0182	169.4389	176.4499	156.4254	152.7653	134.0665	125.8593	142.1126	143.1253	162.3930	173.7654	187.3106	(219)
Water heating fuel used												1916.7305	(219)
Annual totals kWh/year													
Space heating fuel - main system												2373.6270	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.8080, total flow = 37.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													52.5435 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													127.5435 (231)
Electricity for lighting (calculated in Appendix L)													407.2350 (232)
Total delivered energy for all uses													4825.1360 (238)

10a. Fuel costs - using BEDF prices (463)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2373.6270	3.9500	93.7583 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.7305	3.9500	75.7109 (247)
Mechanical ventilation fans	52.5435	18.7000	9.8256 (249)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	407.2350	18.7000	76.1529 (250)
Additional standing charges			91.0000 (251)
Total energy cost			360.4727 (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	2373.6270	0.2160	512.7034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.7305	0.2160	414.0138 (264)
Space and water heating			926.7172 (265)
Pumps and fans	127.5435	0.5190	66.1951 (267)
Energy for lighting	407.2350	0.5190	211.3549 (268)
Total kg/year			1204.2672 (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	2373.6270	1.2200	2895.8250 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.7305	1.2200	2338.4112 (264)
Space and water heating			5234.2362 (265)
Pumps and fans	127.5435	3.0700	391.5585 (267)
Energy for lighting	407.2350	3.0700	1250.2113 (268)
Primary energy kWh/year			6876.0060 (272)
Primary energy kWh/m2/year			74.1748 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

(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	Recommended
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	+ 1.2	-£ 30	-188 kg (15.6%)
U Solar photovoltaic panels	+ 9.7	-£ 341	-947 kg (93.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	2.03 kg/m²	B 86 B 89
Solar photovoltaic panels	£341	10.21 kg/m²	A 96 A 98
Total Savings	£371	12.24 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 463 TEST (27 Jul 2020)
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	£100	£109	-£9
Mains gas	£260	£221	£39
Space heating	£209	£209	£0
Water heating	£76	£46	£30
Lighting	£76	£76	£0
Generated (PV)	-£0	-£341	£341
Total cost of fuels	£360	-£11	£371
Total cost of uses	£361	-£10	£371
Delivered energy	52 kWh/m²	22 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.1 tonnes	1.1 tonnes
CO2 emissions per m²	13 kg/m²	1 kg/m²	12 kg/m²
Primary energy	74 kWh/m²	2 kWh/m²	72 kWh/m²

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	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (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	0.2249	0.2205	0.2161	0.1940	0.1896	0.1676	0.1676	0.1631	0.1764	0.1896	0.1984	0.2072 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m 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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss						(33) + (36) =	58.1673 (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	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211 (38)
Heat transfer coeff	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884 (39)
Average = Sum(39)m / 12 =												96.7884 (39)
HLP	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441 (40)
HLP (average)												1.0441 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)												Total = Sum(45)m = 1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (46)

Southern Energy
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9769	0.9477	0.8716	0.7234	0.5212	0.3536	0.3940	0.6503	0.9022	0.9765	0.9908	(94)
Useful gains	719.0399	803.8755	865.5953	869.9792	754.7399	529.2858	343.8987	362.5342	558.8178	696.5133	690.1207	685.1272	(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													
Month fracti	1452.4591	1408.8629	1276.0036	1067.7937	812.5011	537.3866	344.6924	363.9615	583.7928	902.0828	1205.7984	1457.7320	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	545.6639	406.5516	305.3438	142.4264	42.9743	0.0000	0.0000	0.0000	0.0000	152.9437	371.2879	574.8179	(98)
Space heating												2542.0095	(98)
Space heating per m2											(98) / (4) =	27.4219	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2808.8503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	545.6639	406.5516	305.3438	142.4264	42.9743	0.0000	0.0000	0.0000	0.0000	152.9437	371.2879	574.8179	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	602.9435	449.2282	337.3964	157.3773	47.4854	0.0000	0.0000	0.0000	0.0000	168.9986	410.2629	635.1579	(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	148.0180	109.9989	86.4408	43.3916	16.3363	1.3853	0.0000	24.3515	46.8533	90.5395	125.6901	147.0720	(64)
Efficiency of water heater	89.7976	89.7991	89.7740	89.7319	89.5954	87.3000	87.3000	87.3000	87.3000	89.2830	89.6687	87.3000	(216)
Fuel for water heating, kWh/month	164.8351	122.4945	96.2872	48.3569	18.2334	1.5868	0.0000	27.8941	53.6693	101.4072	140.1716	163.7241	(219)
Water heating fuel used												938.6602	(219)
Annual totals kWh/year													
Space heating fuel - main system												2808.8503	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.8080, total flow = 37.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													52.5435 (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													177.5435 (231)
Electricity for lighting (calculated in Appendix L)													407.2350 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												2605.0495	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2808.8503	3.4800	97.7480	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	938.6602	3.4800	32.6654	(247)
Mechanical ventilation fans	52.5435	13.1900	6.9305	(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	407.2350	13.1900	53.7143	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			99.7228	(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] =	0.3042 (257)
SAP value		95.7569
SAP rating (Section 12)		96 (258)
SAP band		A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2808.8503	0.2160	606.7117	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	938.6602	0.2160	202.7506	(264)
Space and water heating			809.4623	(265)
Pumps and fans	177.5435	0.5190	92.1451	(267)
Energy for lighting	407.2350	0.5190	211.3549	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			216.5250	(272)
CO2 emissions per m2			2.3400	(273)
EI value			97.8929	
EI rating			98	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.3500 (1b)	x 2.4000 (2b)	= 111.2400 (1b) - (3b)
First floor	46.3500 (1c)	x 2.6500 (2c)	= 122.8275 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1852	0.1764	0.1764	0.1631	0.1631	0.1455	0.1499	0.1411	0.1455	0.1543	0.1543	0.1676 (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
Opening Type 1			1.9700	1.3000	2.5610		(26a)
Opening Type 2 (Uw = 1.30)			13.7100	1.2357	16.9420		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	15.6800	78.4500	0.1900	14.9055		(29a)
Plane Roof	46.3500		46.3500	0.1100	5.0985		(30)
Total net area of external elements Aum(A, m ²)			186.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6055		(33)
Party Wall 1			46.2500	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5618 (36)
Total fabric heat loss						(33) + (36) =	58.1673 (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	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211	38.6211 (38)
Heat transfer coeff	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884	96.7884 (39)
Average = Sum(39)m / 12 =												96.7884 (39)
HLP	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441 (40)
HLP (average)												1.0441 (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												2.6609 (42)
Average daily hot water use (litres/day)												97.3964 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.1361	103.2402	99.3444	95.4485	91.5527	87.6568	87.6568	91.5527	95.4485	99.3444	103.2402	107.1361 (44)
Energy conte	158.8797	138.9572	143.3914	125.0121	119.9521	103.5095	95.9168	110.0659	111.3805	129.8032	141.6903	153.8665 (45)
Energy content (annual)										Total = Sum(45)m =		1532.4252 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8320	20.8436	21.5087	18.7518	17.9928	15.5264	14.3875	16.5099	16.7071	19.4705	21.2535	23.0800 (46)

Southern Energy
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Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.12r02

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9840	0.9719	0.9341	0.8303	0.6356	0.3805	0.2180	0.2384	0.5301	0.8559	0.9651	0.9873	(94)
Useful gains	730.1014	801.4079	851.8865	839.0263	663.6457	401.3683	218.9359	228.5803	471.4931	677.2187	702.8678	693.4941	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1383.9395	1347.6992	1196.3299	977.6633	690.1636	402.6999	218.9795	228.6525	479.3175	813.1849	1128.7998	1380.2217	(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													
	486.4555	367.1078	256.2659	99.8187	19.7293	0.0000	0.0000	0.0000	0.0000	101.1589	306.6711	510.9253	(98)
Space heating												2148.1325	(98)
Space heating per m2											(98) / (4) =	23.1730	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2373.6270	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	486.4555	367.1078	256.2659	99.8187	19.7293	0.0000	0.0000	0.0000	0.0000	101.1589	306.6711	510.9253	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	537.5199	405.6440	283.1667	110.2969	21.8004	0.0000	0.0000	0.0000	0.0000	111.7778	338.8631	564.5583	(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	145.9622	111.0519	89.0063	43.9460	19.9634	0.0000	0.0000	19.4861	43.3247	88.3422	122.4567	145.5768	(64)	
Efficiency of water heater	89.7408	89.7361	89.6529	89.4972	88.8618	87.3000	87.3000	87.3000	87.3000	88.9795	89.5632	89.7703	(216)	
Fuel for water heating, kWh/month	162.6487	123.7539	99.2788	49.1033	22.4657	0.0000	0.0000	22.3208	49.6274	99.2837	136.7266	162.1659	(219)	
Water heating fuel used												927.3748	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2373.6270	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 6.8080, total flow = 37.0000, SFP = 0.1840)														
mechanical ventilation fans (SFP = 0.1840)													52.5435	(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													177.5435	(231)
Electricity for lighting (calculated in Appendix L)													407.2350	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)	
Total delivered energy for all uses												2061.6207	(238)	

10a. Fuel costs - using BEDF prices (463)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2373.6270	3.9500	93.7583	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	927.3748	3.9500	36.6313	(247)
Mechanical ventilation fans	52.5435	18.7000	9.8256	(249)
Pumps and fans for heating	75.0000	18.7000	14.0250	(249)
Pump for solar water heating	50.0000	18.7000	9.3500	(249)
Energy for lighting	407.2350	18.7000	76.1529	(250)
Additional standing charges			91.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.7000	-341.1179	(252)
Total energy cost			-10.3747	(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	2373.6270	0.2160	512.7034	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	927.3748	0.2160	200.3130	(264)
Space and water heating			713.0164	(265)
Pumps and fans	177.5435	0.5190	92.1451	(267)
Energy for lighting	407.2350	0.5190	211.3549	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Total kg/year 69.7776 (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	2373.6270	1.2200	2895.8250 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	927.3748	1.2200	1131.3973 (264)
Space and water heating			4027.2223 (265)
Pumps and fans	177.5435	3.0700	545.0585 (267)
Energy for lighting	407.2350	3.0700	1250.2113 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			222.3220 (272)
Primary energy kWh/m2/year			2.3983 (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	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	308.97 (P1)
Transmission heat loss coefficient	58.17 (37)
Summer heat loss coefficient	367.14 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
South	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)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	7.2500	117.5071	0.4500	0.0000	0.9000	345.0301
South	2.8700	112.2060	0.4500	0.0000	0.9000	130.4226
West	3.5900	117.5071	0.4500	0.0000	0.9000	170.8494

total: 646.3022

	Jun	Jul	Aug	
Solar gains	683	646	583	(P4)
Internal gains	468	448	457	
Total summer gains	1151	1095	1040	(P5)

Summer gain/loss ratio	3.13	2.98	2.83	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	19.38	21.13	20.88	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight