

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW021I_046_As_Built				Issued on Date	30/11/2022
Assessment Reference	001	Prop Type Ref	Semi Br Ea Ga			
Property						
SAP Rating	85 B	DER	16.32	TER	17.69	
Environmental	87 B	% DER<TER	7.72			
CO ₂ Emissions (t/year)	1.23	DFEE	43.56	TFEE	50.75	
General Requirements Compliance	Pass	% DFEE<TFEE	14.17			
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, Tel: 07741627521, stuart@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) 17.69 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.32 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.6 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:	4.44 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC 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 North: 0.72 m², No overhang

Windows facing East: 7.25 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					4.4400
Infiltration rate					0.2220 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1887 (21)

	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	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) =	42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (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	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743 (39)
Average = Sum(39)m / 12 =												93.7743 (39)
HLP	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116 (40)
HLP (average)												1.0116 (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	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	23.9358	21.2596	17.2894	13.0892	9.7843	8.2604	8.9256	11.6018	15.5720	19.7722	23.0770	24.6010	(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)	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	409.5629	407.1643	392.1336	367.9855	343.4026	319.9469	304.9051	311.3866	323.9901	348.3607	376.2463	397.2196	(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
North				0.7200	10.6334	0.4500	0.0000			0.7700			2.6528 (74)
East				7.2500	19.6403	0.4500	0.0000			0.7700			49.3388 (76)
West				3.5900	19.6403	0.4500	0.0000			0.7700			24.4312 (80)
Solar gains	76.4228	149.3795	246.2723	360.4468	443.4231	454.7957	432.6167	370.3889	286.7633	177.2705	95.2551	62.8764	(83)
Total gains	485.9858	556.5438	638.4059	728.4323	786.8257	774.7427	737.5217	681.7755	610.7534	525.6312	471.5014	460.0960	(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	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	
alpha	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	
util living area	0.9990	0.9976	0.9921	0.9680	0.8880	0.7230	0.5496	0.6137	0.8713	0.9851	0.9978	0.9993	(86)
MIT	19.8770	20.0079	20.2451	20.5536	20.8198	20.9584	20.9924	20.9865	20.8806	20.5245	20.1342	19.8405	(87)
Th 2	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	(88)
util rest of house	0.9986	0.9967	0.9893	0.9558	0.8471	0.6384	0.4391	0.4997	0.8090	0.9774	0.9969	0.9990	(89)
MIT 2	19.0408	19.1714	19.4072	19.7083	19.9503	20.0543	20.0717	20.0697	20.0050	19.6843	19.2978	19.0043	(90)
Living area fraction									fLA = Living area / (4) =			0.2789	(91)
MIT	19.2740	19.4047	19.6408	19.9440	20.1927	20.3064	20.3284	20.3254	20.2492	19.9186	19.5310	19.2375	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1240	19.2547	19.4908	19.7940	20.0427	20.1564	20.1784	20.1754	20.0992	19.7686	19.3810	19.0875	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	485.0843	554.1666	630.0118	692.8853	665.2678	500.8860	333.2888	349.5681	495.3474	511.9571	469.5819	459.4632	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1390.1057	1346.0972	1218.2048	1021.5791	782.3353	521.0465	335.5663	354.0320	562.5692	859.7812	1151.6447	1396.0642	(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	673.3359	532.1774	437.6156	236.6596	87.0982	0.0000	0.0000	0.0000	0.0000	258.7811	491.0852	696.8312	(98)
Space heating												3413.5841	(98)
Space heating per m2												(98) / (4) =	36.8240 (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												3771.9161 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	673.3359	532.1774	437.6156	236.6596	87.0982	0.0000	0.0000	0.0000	0.0000	258.7811	491.0852	696.8312 (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)	744.0176	588.0413	483.5532	261.5023	96.2411	0.0000	0.0000	0.0000	0.0000	285.9459	542.6356	769.9792 (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	89.8269	89.7700	89.6305	89.2911	88.5334	87.3000	87.3000	87.3000	87.3000	89.3300	89.7098	87.3000 (216)
Fuel for water heating, kWh/month	192.6122	169.0052	175.7100	155.2353	151.3240	134.0665	125.8593	142.1126	143.1253	161.0536	173.1619	89.8602 (217)
Water heating fuel used												186.9486 (219)
Annual totals kWh/year												1910.2146 (219)
Space heating fuel - main system												3771.9161 (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)												422.7134 (232)
Total delivered energy for all uses												6232.3876 (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	3771.9161	0.2160	814.7339 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1910.2146	0.2160	412.6064 (264)
Space and water heating			1227.3402 (265)
Pumps and fans	127.5435	0.5190	66.1951 (267)
Energy for lighting	422.7134	0.5190	219.3883 (268)
Total CO2, kg/year			1512.9236 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3200 (273)

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

DER		16.3200 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		33.8875 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		33.8875 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)			11.5600	1.3258	15.3258		(27)
Rackhams White/Grey 150TS			46.3500	0.1300	6.0255		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1800	14.5080		(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) =		44.2488		(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)							9.6393 (36)
Total fabric heat loss						(33) + (36) =	53.8881 (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	98.9963	98.7444	98.4975	97.3378	97.1208	96.1107	96.1107	95.9236	96.4997	97.1208	97.5597	98.0186 (39)
Average = Sum(39)m / 12 =												97.3367 (39)
HLP	1.0679	1.0652	1.0625	1.0500	1.0477	1.0368	1.0368	1.0348	1.0410	1.0477	1.0524	1.0574 (40)
HLP (average)												1.0500 (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)
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	23.9358	21.2596	17.2894	13.0892	9.7843	8.2604	8.9256	11.6018	15.5720	19.7722	23.0770	24.6010	(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	421.9356	419.5410	404.4073	379.6075	354.3684	330.2586	315.2245	322.3597	335.6229	360.6452	388.6290	409.5963	(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			
North				0.7200	10.6334	0.6300	0.7000	0.7700	2.3398 (74)			
East				7.2500	19.6403	0.6300	0.7000	0.7700	43.5168 (76)			
West				3.5900	19.6403	0.6300	0.7000	0.7700	21.5483 (80)			
Solar gains	67.4049	131.7527	217.2121	317.9141	391.0992	401.1298	381.5679	326.6830	252.9252	156.3526	84.0150	55.4570 (83)
Total gains	489.3405	551.2937	621.6194	697.5216	745.4676	731.3884	696.7924	649.0427	588.5481	516.9978	472.6440	465.0533 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	65.0277	65.1936	65.3570	66.1357	66.2834	66.9801	66.9801	67.1107	66.7100	66.2834	65.9852	65.6763	
alpha	5.3352	5.3462	5.3571	5.4090	5.4189	5.4653	5.4653	5.4740	5.4473	5.4189	5.3990	5.3784	
util living area	0.9989	0.9977	0.9934	0.9752	0.9129	0.7640	0.5907	0.6512	0.8920	0.9869	0.9978	0.9992	(86)
MIT	19.8024	19.9301	20.1654	20.4865	20.7701	20.9417	20.9883	20.9807	20.8544	20.4840	20.0877	19.7819	(87)
Th 2	20.0271	20.0294	20.0315	20.0419	20.0438	20.0528	20.0528	20.0545	20.0493	20.0438	20.0399	20.0358	(88)
util rest of house	0.9986	0.9969	0.9910	0.9652	0.8772	0.6794	0.4719	0.5314	0.8342	0.9800	0.9969	0.9989	(89)
MIT 2	18.4179	18.6061	18.9507	19.4202	19.8072	20.0116	20.0482	20.0459	19.9235	19.4230	18.8445	18.3942	(90)
Living area fraction	18.8040	18.9753	19.2894	19.7176	20.0757	20.2710	20.3103	20.3066	20.1831	19.7189	19.1912	18.7812	(91)
MIT	18.8040	18.9753	19.2894	19.7176	20.0757	20.2710	20.3103	20.3066	20.1831	19.7189	19.1912	18.7812	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8040	18.9753	19.2894	19.7176	20.0757	20.2710	20.3103	20.3066	20.1831	19.7189	19.1912	18.7812	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	488.3055	548.9158	614.3794	670.1905	654.9491	512.3191	352.0683	366.6725	496.6120	504.9745	470.6073	464.3044	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1435.8388	1389.8586	1259.7234	1052.9573	813.4570	545.0407	356.6034	374.7344	587.0130	885.6322	1179.6150	1429.2256	(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	704.9647	565.1136	480.1359	275.5921	117.9299	0.0000	0.0000	0.0000	0.0000	283.2093	510.4855	717.9014	(98)
Space heating												3655.3324	(98)
Space heating per m2												39.4318	(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													3913.6321 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	704.9647	565.1136	480.1359	275.5921	117.9299	0.0000	0.0000	0.0000	0.0000	283.2093	510.4855	717.9014	(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)	754.7802	605.0466	514.0642	295.0665	126.2633	0.0000	0.0000	0.0000	0.0000	303.2220	546.5584	768.6310	(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	87.8650	87.6803	87.2420	86.2309	84.1989	80.3000	80.3000	80.3000	80.3000	86.1816	87.4065	80.3000	(216)
Fuel for water heating, kWh/month	238.8194	210.9763	222.3885	199.5603	197.8722	182.7367	175.0756	195.1683	197.3237	209.3579	218.5253	232.9028	(219)
Water heating fuel used												2480.7070	(219)
Annual totals kWh/year													
Space heating fuel - main system												3913.6321	(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)												422.7134	(232)
Total delivered energy for all uses												6892.0526	(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	3913.6321	0.2160	845.3445 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2480.7070	0.2160	535.8327 (264)
Space and water heating			1381.1773 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	422.7134	0.5190	219.3883 (268)
Total CO2, kg/m2/year			1639.4905 (272)
Emissions per m2 for space and water heating			14.8994 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3666 (272b)
Emissions per m2 for pumps and fans			0.4199 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8994 * 1.00) + 2.3666 + 0.4199, rounded to 2 d.p.			17.6900 (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					4.4400
Infiltration rate					0.3502 (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) =	0.2976 (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	0.3795	0.3721	0.3646	0.3274	0.3200	0.2828	0.2828	0.2753	0.2976	0.3200	0.3348	0.3497 (22b)
Effective ac	0.5720	0.5692	0.5665	0.5536	0.5512	0.5400	0.5400	0.5379	0.5443	0.5512	0.5561	0.5612 (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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) =	42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.1832	43.9672	43.7555	42.7611	42.5751	41.7090	41.7090	41.5487	42.0426	42.5751	42.9515	43.3449 (38)
Heat transfer coeff	99.3364	99.1204	98.9087	97.9143	97.7283	96.8622	96.8622	96.7018	97.1958	97.7283	98.1046	98.4981 (39)
Average = Sum(39)m / 12 =												97.9134 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0716	1.0693	1.0670	1.0562	1.0542	1.0449	1.0449	1.0432	1.0485	1.0542	1.0583	1.0625 (40)
HLP (average)												1.0562 (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	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)

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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	(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	(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	23.9358	21.2596	17.2894	13.0892	9.7843	8.2604	8.9256	11.6018	15.5720	19.7722	23.0770	24.6010	(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	376.1865	374.6040	361.2686	339.4282	316.3445	294.9972	281.7443	285.9303	297.7156	319.6982	344.8907	364.6558	(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	
North	0.7200	10.6334	0.4500	0.0000	0.7700	2.6528	(74)
East	7.2500	19.6403	0.4500	0.0000	0.7700	49.3388	(76)
West	3.5900	19.6403	0.4500	0.0000	0.7700	24.4312	(80)

Solar gains	76.4228	149.3795	246.2723	360.4468	443.4231	454.7957	432.6167	370.3889	286.7633	177.2705	95.2551	62.8764	(83)
Total gains	452.6094	523.9834	607.5409	699.8750	759.7675	749.7930	714.3610	656.3192	584.4789	496.9687	440.1458	427.5322	(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	64.8051	64.9463	65.0853	65.7463	65.8714	66.4604	66.4604	66.5706	66.2323	65.8714	65.6187	65.3566	
alpha	5.3203	5.3298	5.3390	5.3831	5.3914	5.4307	5.4307	5.4380	5.4155	5.3914	5.3746	5.3571	
util living area	0.9993	0.9982	0.9941	0.9751	0.9084	0.7546	0.5815	0.6491	0.8959	0.9891	0.9984	0.9995	(86)
MIT	19.7598	19.8969	20.1460	20.4822	20.7745	20.9441	20.9889	20.9805	20.8483	20.4589	20.0478	19.7363	(87)
Th 2	20.0241	20.0260	20.0279	20.0367	20.0384	20.0461	20.0461	20.0475	20.0431	20.0384	20.0350	20.0315	(88)
util rest of house	0.9990	0.9976	0.9919	0.9650	0.8715	0.6691	0.4632	0.5288	0.8391	0.9832	0.9978	0.9993	(89)
MIT 2	18.8834	19.0219	19.2714	19.6089	19.8809	20.0194	20.0431	20.0416	19.9531	19.5911	19.1801	18.8660	(90)
Living area fraction									fLA = Living area / (4) =			0.2789	(91)
MIT	19.1278	19.2659	19.5153	19.8525	20.1301	20.2772	20.3068	20.3035	20.2027	19.8331	19.4220	19.1087	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1278	19.2659	19.5153	19.8525	20.1301	20.2772	20.3068	20.3035	20.2027	19.8331	19.4220	19.1087	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	452.0204	522.3736	601.6677	673.7168	665.2411	518.3980	354.7413	369.3202	496.9715	487.8081	438.9171	427.1241	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1472.9426	1423.9516	1287.3235	1072.4016	823.8568	549.9085	359.0526	377.4723	593.1594	902.3347	1208.8476	1468.4757	(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	759.5661	605.8604	510.1279	287.0530	118.0101	0.0000	0.0000	0.0000	0.0000	308.4079	554.3500	774.7656	(98)
Space heating												3918.1410	(98)
Space heating per m2										(98) / (4) =		42.2669	(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	910.5046	716.7802	734.9337	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8731	0.9326	0.9060	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	794.9344	668.4745	665.8221	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	978.0925	934.6122	868.8319	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	131.8738	198.0064	151.0393	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												480.9196 (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	32.9685	49.5016	37.7598	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.2299 (107)
Space cooling per m2												1.2970 (108)
Energy for space heating												42.2669 (99)
Energy for space cooling												1.2970 (108)
Total												43.5639 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.6 (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		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.0675 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1282 (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)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
	0.4098	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			1.9700	1.2000	2.3640			(26a)					
TER Opening Type (Uw = 1.40)			11.5600	1.3258	15.3258			(27)					
Rackhams White/Grey 150TS			46.3500	0.1300	6.0255			(28a)					
Brick Cavity	94.1300	13.5300	80.6000	0.1800	14.5080			(29a)					
Plane Roof	46.3500		46.3500	0.1300	6.0255			(30)					
Total net area of external elements Aum(A, m2)			186.8300					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		44.2488			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.6393 (36)					
Total fabric heat loss						(33) + (36) =		53.8881 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 45.1083	Feb 44.8564	Mar 44.6095	Apr 43.4497	May 43.2327	Jun 42.2226	Jul 42.2226	Aug 42.0356	Sep 42.6117	Oct 43.2327	Nov 43.6717	Dec 44.1306	(38)
Heat transfer coeff	98.9963	98.7444	98.4975	97.3378	97.1208	96.1107	96.1107	95.9236	96.4997	97.1208	97.5597	98.0186	(39)
Average = Sum(39)m / 12 =												97.3367	(39)
HLP	Jan 1.0679	Feb 1.0652	Mar 1.0625	Apr 1.0500	May 1.0477	Jun 1.0368	Jul 1.0368	Aug 1.0348	Sep 1.0410	Oct 1.0477	Nov 1.0524	Dec 1.0574	(40)
HLP (average)												1.0500	(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	Jan 107.1361	Feb 103.2402	Mar 99.3444	Apr 95.4485	May 91.5527	Jun 87.6568	Jul 87.6568	Aug 91.5527	Sep 95.4485	Oct 99.3444	Nov 103.2402	Dec 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	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	23.9358	21.2596	17.2894	13.0892	9.7843	8.2604	8.9256	11.6018	15.5720	19.7722	23.0770	24.6010	(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	376.1865	374.6040	361.2686	339.4282	316.3445	294.9972	281.7443	285.9303	297.7156	319.6982	344.8907	364.6558	(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
North				0.7200	10.6334	0.6300	0.7000			0.7700			2.3398 (74)
East				7.2500	19.6403	0.6300	0.7000			0.7700			43.5168 (76)
West				3.5900	19.6403	0.6300	0.7000			0.7700			21.5483 (80)

Solar gains	67.4049	131.7527	217.2121	317.9141	391.0992	401.1298	381.5679	326.6830	252.9252	156.3526	84.0150	55.4570	(83)
Total gains	443.5915	506.3566	578.4807	657.3423	707.4436	696.1271	663.3122	612.6133	550.6408	476.0508	428.9057	420.1128	(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)													
tau	65.0277	65.1936	65.3570	66.1357	66.2834	66.9801	66.9801	67.1107	66.7100	66.2834	65.9852	65.6763	
alpha	5.3352	5.3462	5.3571	5.4090	5.4189	5.4653	5.4653	5.4740	5.4473	5.4189	5.3990	5.3784	
util living area	0.9993	0.9985	0.9953	0.9807	0.9271	0.7886	0.6167	0.6823	0.9130	0.9910	0.9986	0.9995	(86)
MIT	19.7556	19.8844	20.1224	20.4499	20.7447	20.9316	20.9857	20.9759	20.8314	20.4443	20.0431	19.7358	(87)
Th 2	20.0271	20.0294	20.0315	20.0419	20.0438	20.0528	20.0528	20.0545	20.0493	20.0438	20.0399	20.0358	(88)
util rest of house	0.9991	0.9980	0.9935	0.9726	0.8954	0.7059	0.4945	0.5604	0.8620	0.9860	0.9981	0.9994	(89)
MIT 2	18.8817	19.0121	19.2511	19.5825	19.8612	20.0190	20.0488	20.0469	19.9465	19.5815	19.1793	18.8689	(90)
Living area fraction									fLA = Living area / (4) =			0.2789	(91)
MIT	19.1254	19.2553	19.4940	19.8244	20.1075	20.2735	20.3101	20.3060	20.1933	19.8221	19.4202	19.1106	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1254	19.2553	19.4940	19.8244	20.1075	20.2735	20.3101	20.3060	20.1933	19.8221	19.4202	19.1106	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9974	0.9922	0.9703	0.8979	0.7270	0.5291	0.5948	0.8712	0.9845	0.9975	0.9991	(94)
Useful gains	443.0684	505.0292	573.9485	637.8367	635.2326	506.1043	350.9312	364.3866	479.7342	468.6631	427.8462	419.7462	(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	1467.6560	1417.5063	1279.8800	1063.3521	816.5470	545.2829	356.5789	374.6775	587.9972	895.6568	1201.9519	1461.5197	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	762.2932	613.1846	525.2130	306.3710	134.8979	0.0000	0.0000	0.0000	0.0000	317.6834	557.3561	775.0795	(98)
Space heating												3992.0787	(98)
Space heating per m2										(98) / (4) =		43.0645	(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	903.4403	711.2189	729.0194	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8508	0.9183	0.8897	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	768.6627	653.1004	648.6075	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	915.3662	874.9448	817.7471	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	105.6265	165.0522	125.8398	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												396.5185	(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	26.4066	41.2630	31.4600	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												99.1296 (107)
Space cooling per m2												1.0694 (108)
Energy for space heating												43.0645 (99)
Energy for space cooling												1.0694 (108)
Total												44.1339 (109)
Target Fabric Energy Efficiency (TFEE)												50.8 (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					4.4400
Infiltration rate					0.2220 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1887 (21)

	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	0.1981	0.1887	0.1887	0.1745	0.1745	0.1557	0.1604	0.1510	0.1557	0.1651	0.1651	0.1793 (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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) = 42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (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	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743 (39)
Average = Sum(39)m / 12 =												93.7743 (39)
HLP	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116 (40)
HLP (average)												1.0116 (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

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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	59.8395	53.1489	43.2236	32.7230	24.4608	20.6509	22.3140	29.0046	38.9299	49.4304	57.6926	61.5026	(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	609.5560	604.3899	580.2619	543.1244	505.1404	471.4628	452.1171	461.3661	483.0669	520.4269	561.7136	592.9088	(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
North				0.7200	11.9814		0.4500		0.0000		0.7700		2.9891 (74)
East				7.2500	22.3313		0.4500		0.0000		0.7700		56.0991 (76)
West				3.5900	22.3313		0.4500		0.0000		0.7700		27.7787 (80)
Solar gains	86.8669	152.7810	248.4627	373.8147	447.1555	490.4311	461.6177	404.7635	313.2995	193.5143	110.9310	70.7694	(83)
Total gains	696.4229	757.1709	828.7246	916.9391	952.2960	961.8939	913.7348	866.1296	796.3663	713.9412	672.6445	663.6783	(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	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	
alpha	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	
util living area	0.9923	0.9868	0.9664	0.8962	0.7319	0.4829	0.3178	0.3458	0.6549	0.9218	0.9834	0.9939	(86)
MIT	20.1686	20.2757	20.5069	20.7722	20.9447	20.9954	20.9997	20.9994	20.9767	20.7678	20.4205	20.1359	(87)
Th 2	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	(88)
util rest of house	0.9898	0.9826	0.9553	0.8642	0.6655	0.3957	0.2230	0.2461	0.5625	0.8894	0.9770	0.9919	(89)
MIT 2	19.3308	19.4363	19.6613	19.9058	20.0430	20.0723	20.0736	20.0736	20.0643	19.9078	19.5800	19.2985	(90)
Living area fraction	19.5644	19.6703	19.8971	20.1474	20.2945	20.3297	20.3319	20.3318	20.3187	20.1476	19.8144	19.5320	(92)
MIT	19.5644	19.6703	19.8971	20.1474	20.2945	20.3297	20.3319	20.3318	20.3187	20.1476	19.8144	19.5320	(91)
Temperature adjustment	19.4144	19.5203	19.7471	19.9974	20.1445	20.1797	20.1819	20.1818	20.1687	19.9976	19.6644	19.3820	(93)
adjusted MIT	19.4144	19.5203	19.7471	19.9974	20.1445	20.1797	20.1819	20.1818	20.1687	19.9976	19.6644	19.3820	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	687.6774	741.4830	787.6842	789.6919	638.9445	390.3908	213.9309	223.2644	455.9134	632.7294	654.7026	656.9376	(94)
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	1342.3222	1305.3708	1157.8394	946.8748	669.9658	391.9497	213.9808	223.3509	465.9396	787.4814	1093.8173	1339.2859	(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	487.0557	378.9326	275.3955	113.1717	23.0798	0.0000	0.0000	0.0000	0.0000	115.1355	316.1626	507.6671	(98)
Space heating												2216.6005	(98)
RHI space heating demand												2217	(98)

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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					4.4400
Infiltration rate					0.2220 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1887 (21)

	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	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) =	42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (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	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743 (39)
Average = Sum(39)m / 12 =												93.7743 (39)
HLP	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116 (40)
HLP (average)												1.0116 (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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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	59.8395	53.1489	43.2236	32.7230	24.4608	20.6509	22.3140	29.0046	38.9299	49.4304	57.6926	61.5026	(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	609.5560	604.3899	580.2619	543.1244	505.1404	471.4628	452.1171	461.3661	483.0669	520.4269	561.7136	592.9088	(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
North					0.7200	10.6334	0.4500	0.0000			0.7700			2.6528 (74)
East					7.2500	19.6403	0.4500	0.0000			0.7700			49.3388 (76)
West					3.5900	19.6403	0.4500	0.0000			0.7700			24.4312 (80)
Solar gains	76.4228	149.3795	246.2723	360.4468	443.4231	454.7957	432.6167	370.3889	286.7633	177.2705	95.2551	62.8764	(83)	
Total gains	685.9788	753.7693	826.5342	903.5712	948.5635	926.2585	884.7337	831.7550	769.8301	697.6974	656.9687	655.7852	(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	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489		
alpha	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766		
util living area	0.9943	0.9895	0.9746	0.9263	0.8102	0.6264	0.4628	0.5121	0.7658	0.9506	0.9890	0.9956	(86)	
MIT	20.0813	20.2060	20.4240	20.6906	20.8923	20.9793	20.9967	20.9944	20.9402	20.6757	20.3206	20.0412	(87)	
Th 2	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	(88)	
util rest of house	0.9926	0.9862	0.9665	0.9032	0.7580	0.5448	0.3673	0.4124	0.6893	0.9299	0.9849	0.9942	(89)	
MIT 2	19.2440	19.3674	19.5810	19.8328	20.0048	20.0647	20.0729	20.0721	20.0430	19.8247	19.4818	19.2042	(90)	
Living area fraction	19.4775	19.6013	19.8161	20.0720	20.2523	20.3197	20.3305	20.3293	20.2932	20.0620	19.7157	19.4376	(91)	
MIT	19.4775	19.6013	19.8161	20.0720	20.2523	20.3197	20.3305	20.3293	20.2932	20.0620	19.7157	19.4376	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.3275	19.4513	19.6661	19.9220	20.1023	20.1697	20.1805	20.1793	20.1432	19.9120	19.5657	19.2876	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	679.5687	741.1907	795.1445	812.0663	720.6550	512.7424	334.8188	352.6495	535.4365	645.6845	645.1283	650.9230	(94)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1409.1930	1364.5357	1234.6413	1033.5845	787.9205	522.2952	335.7584	354.4027	566.6941	873.2245	1168.9598	1414.8310	(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	542.8405	418.8879	326.9856	159.4931	50.0455	0.0000	0.0000	0.0000	0.0000	169.2898	377.1587	568.3476	(98)
Space heating												2613.0486	(98)
Space heating per m2												28.1882	(99)

8c. Space cooling requirement

Not applicable

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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													2887.3465 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	542.8405	418.8879	326.9856	159.4931	50.0455	0.0000	0.0000	0.0000	0.0000	169.2898	377.1587	568.3476	(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)	599.8237	462.8596	361.3101	176.2354	55.2989	0.0000	0.0000	0.0000	0.0000	187.0605	416.7499	628.0083	(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	89.7053	89.6265	89.4343	88.9834	88.1477	87.3000	87.3000	87.3000	87.3000	89.0012	89.5425	87.3000	(216)
Fuel for water heating, kWh/month	192.8734	169.2758	176.0955	155.7721	151.9861	134.0665	125.8593	142.1126	143.1253	161.6486	173.4854	187.1793	(219)
Water heating fuel used												1913.4799	(219)
Annual totals kWh/year													
Space heating fuel - main system												2887.3465	(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)													422.7134 (232)
Total delivered energy for all uses													5351.0833 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2887.3465	3.4800	100.4797 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.4799	3.4800	66.5891 (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	422.7134	13.1900	55.7559 (250)
Additional standing charges			120.0000 (251)
Total energy cost			359.6476 (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] =	1.0970 (257)
SAP value		84.6973
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	2887.3465	0.2160	623.6668 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.4799	0.2160	413.3117 (264)
Space and water heating			1036.9785 (265)
Pumps and fans	127.5435	0.5190	66.1951 (267)
Energy for lighting	422.7134	0.5190	219.3883 (268)
Total kg/year			1322.5618 (272)
CO2 emissions per m2			14.2700 (273)
EI value			87.1298
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	$3.48 / 0.8862 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8862 = 0.2437$, 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					4.4400
Infiltration rate					0.2220 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1887 (21)

	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	0.1981	0.1887	0.1887	0.1745	0.1745	0.1557	0.1604	0.1510	0.1557	0.1651	0.1651	0.1793 (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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) =	42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (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	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743 (39)
Average = Sum(39)m / 12 =												93.7743 (39)
HLP	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116 (40)
HLP (average)												1.0116 (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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[illegible]

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	59.8395	53.1489	43.2236	32.7230	24.4608	20.6509	22.3140	29.0046	38.9299	49.4304	57.6926	61.5026 (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	609.5560	604.3899	580.2619	543.1244	505.1404	471.4628	452.1171	461.3661	483.0669	520.4269	561.7136	592.9088 (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	
North					0.7200	11.9814	0.4500	0.0000	0.7700		2.9891 (74)	
East					7.2500	22.3313	0.4500	0.0000	0.7700		56.0991 (76)	
West					3.5900	22.3313	0.4500	0.0000	0.7700		27.7787 (80)	
Solar gains	86.8669	152.7810	248.4627	373.8147	447.1555	490.4311	461.6177	404.7635	313.2955	193.5143	110.9310	70.7694 (83)
Total gains	696.4229	757.1709	828.7246	916.9391	952.2960	961.8939	913.7348	866.1296	796.3663	713.9412	672.6445	663.6783 (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	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489	68.6489
alpha	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766	5.5766
util living area	0.9923	0.9868	0.9664	0.8962	0.7319	0.4829	0.3178	0.3458	0.6549	0.9218	0.9834	0.9939 (86)
MIT	20.1686	20.2757	20.5069	20.7722	20.9447	20.9954	20.9997	20.9994	20.9767	20.7678	20.4205	20.1359 (87)
Th 2	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737	20.0737 (88)
util rest of house	0.9898	0.9826	0.9553	0.8642	0.6655	0.3957	0.2230	0.2461	0.5625	0.8894	0.9770	0.9919 (89)
MIT 2	19.3308	19.4363	19.6613	19.9058	20.0430	20.0723	20.0736	20.0736	20.0643	19.9078	19.5800	19.2985 (90)
Living area fraction									fLA = Living area / (4) =			0.2789 (91)
MIT	19.5644	19.6703	19.8971	20.1474	20.2945	20.3297	20.3319	20.3318	20.3187	20.1476	19.8144	19.5320 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4144	19.5203	19.7471	19.9974	20.1445	20.1797	20.1819	20.1818	20.1687	19.9976	19.6644	19.3820 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9874	0.9793	0.9505	0.8612	0.6710	0.4059	0.2341	0.2578	0.5725	0.8862	0.9733	0.9898 (94)
Useful gains	687.6774	741.4830	787.6842	789.6919	638.9445	390.3098	213.9309	223.2644	455.9134	632.7294	654.7026	656.9376 (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	1342.3222	1305.3708	1157.8394	946.8748	669.9658	391.9497	213.9808	223.3509	465.9396	787.4814	1093.8173	1339.2859 (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	487.0557	378.9326	275.3955	113.1717	23.0798	0.0000	0.0000	0.0000	0.0000	115.1355	316.1626	507.6671 (98)
Space heating												2216.6005 (98)
Space heating per m2										(98) / (4) =		

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													2449.2823 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.0557	378.9326	275.3955	113.1717	23.0798	0.0000	0.0000	0.0000	0.0000	115.1355	316.1626	507.6671	(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)	538.1831	418.7101	304.3044	125.0516	25.5025	0.0000	0.0000	0.0000	0.0000	127.2215	349.3509	560.9581	(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	89.6387	89.5614	89.3090	88.7099	87.7560	87.3000	87.3000	87.3000	87.3000	88.6941	89.4201	87.3000	(216)
Fuel for water heating, kWh/month	193.0165	169.3989	176.3426	156.2523	152.6644	134.0665	125.8593	142.1126	143.1253	162.2083	173.7229	187.3187	(219)
Water heating fuel used												1916.0884	(219)
Annual totals kWh/year													
Space heating fuel - main system												2449.2823	(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)													422.7134 (232)
Total delivered energy for all uses													4915.6276 (238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2449.2823	3.7400	91.6032 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.0884	3.7400	71.6617 (247)
Mechanical ventilation fans	52.5435	20.4300	10.7346 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	422.7134	20.4300	86.3604 (250)
Additional standing charges			95.0000 (251)
Total energy cost			370.6823 (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	2449.2823	0.2160	529.0450 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.0884	0.2160	413.8751 (264)
Space and water heating			942.9201 (265)
Pumps and fans	127.5435	0.5190	66.1951 (267)
Energy for lighting	422.7134	0.5190	219.3883 (268)
Total kg/year			1228.5034 (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	2449.2823	1.2200	2988.1244 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.0884	1.2200	2337.6278 (264)
Space and water heating			5325.7523 (265)
Pumps and fans	127.5435	3.0700	391.5585 (267)
Energy for lighting	422.7134	3.0700	1297.7302 (268)
Primary energy kWh/year			7015.0409 (272)
Primary energy kWh/m2/year			75.6747 (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	-£ 27	-188 kg (15.3%)
U Solar photovoltaic panels	+ 9.7	-£ 373	-947 kg (91.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£27	2.02 kg/m²	B 86 B 89
Solar photovoltaic panels	£373	10.21 kg/m²	A 96 A 98
Total Savings	£399	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 508 TEST (28 Oct 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£112	£123	-£10
Mains gas	£258	£221	£37
Space heating	£213	£213	£0
Water heating	£72	£45	£27
Lighting	£86	£86	£0
Generated (PV)	-£0	-£373	£373
Total cost of fuels	£370	-£29	£400
Total cost of uses	£371	-£29	£400
Delivered energy	53 kWh/m²	23 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	76 kWh/m²	4 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					4.4400
Infiltration rate					0.2220 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1887 (21)

	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	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) =	42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (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	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743 (39)
Average = Sum(39)m / 12 =												93.7743 (39)
HLP	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116 (40)
HLP (average)												1.0116 (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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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)
Aperture area of solar collector												3.9924 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1835 (H8)
Utilisation factor												0.5704 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.3964 (H14)
Volume ratio Veff/V												0.7700 (H15)
Solar storage volume factor												0.9477 (H16)
Solar input												-862.1135 (H17)
Solar input	-24.9996	-41.7171	-71.0490	-95.2197	-117.6359	-115.6548	-114.1264	-99.7128	-78.0951	-53.3298	-29.6531	-20.9204 (G3)
												-862.1135 (G3)
Output from w/h	148.0180	109.9989	86.4408	43.3916	16.3363	1.3853	0.0000	24.3515	46.8533	90.5395	125.6901	147.0720 (G4)
												840.0773 (G4)
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 (G5)

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	59.8395	53.1489	43.2236	32.7230	24.4608	20.6509	22.3140	29.0046	38.9299	49.4304	57.6926	61.5026 (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	609.5560	604.3899	580.2619	543.1244	505.1404	471.4628	452.1171	461.3661	483.0669	520.4269	561.7136	592.9088 (73)

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.7200	10.6334	0.4500	0.0000	0.7700	2.6528 (74)
East	7.2500	19.6403	0.4500	0.0000	0.7700	49.3388 (76)
West	3.5900	19.6403	0.4500	0.0000	0.7700	24.4312 (80)

7. Mean internal temperature (heating season)

8. Space heating requirement

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	0.9907	0.9833	0.9620	0.8987	0.7597	0.5536	0.3784	0.4240	0.6955	0.9255	0.9820	0.9926	(94)
Useful gains	679.5687	741.1907	795.1445	812.0663	720.6550	512.7424	334.8188	352.6495	535.4365	645.6845	645.1283	650.9230	(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	1409.1930	1364.5357	1234.6413	1033.5845	787.9205	522.2952	335.7584	354.4027	566.6941	873.2245	1168.9598	1414.8310	(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	542.8405	418.8879	326.9856	159.4931	50.0455	0.0000	0.0000	0.0000	0.0000	169.2898	377.1587	568.3476	(98)
Space heating												2613.0486	(98)
Space heating per m2												28.1882	(99)
											(98) / (4) =		

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													2887.3465 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	542.8405	418.8879	326.9856	159.4931	50.0455	0.0000	0.0000	0.0000	0.0000	169.2898	377.1587	568.3476	(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)	599.8237	462.8596	361.3101	176.2354	55.2989	0.0000	0.0000	0.0000	0.0000	187.0605	416.7499	628.0083	(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	89.7948	89.8153	89.8117	89.7960	89.6909	87.3000	87.3000	87.3000	87.3000	89.3586	89.6783	89.8231	(216)
Fuel for water heating, kWh/month	164.8403	122.4724	96.2468	48.3224	18.2140	1.5868	0.0000	27.8941	53.6693	101.3214	140.1566	163.7351	(219)
Water heating fuel used												938.4591	(219)
Annual totals kWh/year													
Space heating fuel - main system												2887.3465	(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)													422.7134 (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												2698.8231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2887.3465	3.4800	100.4797	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	938.4591	3.4800	32.6584	(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	422.7134	13.1900	55.7559	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			104.4890	(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] =	0.3187 (257)
SAP value		95.5541
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	2887.3465	0.2160	623.6668	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	938.4591	0.2160	202.7072	(264)
Space and water heating			826.3740	(265)
Pumps and fans	177.5435	0.5190	92.1451	(267)
Energy for lighting	422.7134	0.5190	219.3883	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			241.4701	(272)
CO2 emissions per m2			2.6000	(273)
EI value			97.6502	
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					4.4400
Infiltration rate					0.2220 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1887 (21)

	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	0.1981	0.1887	0.1887	0.1745	0.1745	0.1557	0.1604	0.1510	0.1557	0.1651	0.1651	0.1793 (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)			11.5600	1.2357	14.2852		(27)
Rackhams White/Grey 150TS			46.3500	0.1100	5.0985		(28a)
Brick Cavity	94.1300	13.5300	80.6000	0.1900	15.3140		(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) =	42.3572		(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)							12.7960 (36)
Total fabric heat loss						(33) + (36) =	55.1532 (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	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743	93.7743 (39)
Average = Sum(39)m / 12 =												93.7743 (39)
HLP	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116	1.0116 (40)
HLP (average)												1.0116 (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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8. Space heating requirement

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	0.9874	0.9793	0.9505	0.8612	0.6710	0.4059	0.2341	0.2578	0.5725	0.8862	0.9733	0.9898	(94)
Useful gains	687.6774	741.4830	787.6842	789.6919	638.9445	390.3908	213.9309	223.2644	455.9134	632.7294	654.7026	656.9376	(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	1342.3222	1305.3708	1157.8394	946.8748	669.9658	391.9497	213.9808	223.3509	465.9396	787.4814	1093.8173	1339.2859	(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	487.0557	378.9326	275.3955	113.1717	23.0798	0.0000	0.0000	0.0000	0.0000	115.1355	316.1626	507.6671	(98)
Space heating												2216.6005	(98)
Space heating per m2												23.9115	(99)

(98) / (4) =

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	2449.2823	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.0557	378.9326	275.3955	113.1717	23.0798	0.0000	0.0000	0.0000	0.0000	115.1355	316.1626	507.6671	(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)	538.1831	418.7101	304.3044	125.0516	25.5025	0.0000	0.0000	0.0000	0.0000	127.2215	349.3509	560.9581	(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	89.7415	89.7544	89.6969	89.5816	88.9872	87.3000	87.3000	87.3000	87.3000	89.0823	89.5832	89.7667	(216)
Fuel for water heating, kWh/month	162.6474	123.7287	99.2300	49.0570	22.4341	0.0000	0.0000	22.3208	49.6274	99.1691	136.6960	162.1724	(219)
Water heating fuel used												927.0829	(219)
Annual totals kWh/year													
Space heating fuel - main system												2449.2823	(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)												422.7134	(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												2152.4625	(238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2449.2823	3.7400	91.6032	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	927.0829	3.7400	34.6729	(247)
Mechanical ventilation fans	52.5435	20.4300	10.7346	(249)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	422.7134	20.4300	86.3604	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	20.4300	-372.6758	(252)
Total energy cost			-28.7673	(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	2449.2823	0.2160	529.0450	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	927.0829	0.2160	200.2499	(264)
Space and water heating			729.2949	(265)
Pumps and fans	177.5435	0.5190	92.1451	(267)
Energy for lighting	422.7134	0.5190	219.3883	(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 94.0894 (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	2449.2823	1.2200	2988.1244 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	927.0829	1.2200	1131.0412 (264)
Space and water heating			4119.1656 (265)
Pumps and fans	177.5435	3.0700	545.0585 (267)
Energy for lighting	422.7134	3.0700	1297.7302 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			361.7842 (272)
Primary energy kWh/m2/year			3.9027 (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	55.15 (37)
Summer heat loss coefficient	364.12 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	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
North	0.7200	81.1852	0.4500	0.0000	0.9000	23.6736
East	7.2500	117.5071	0.4500	0.0000	0.9000	345.0301
West	3.5900	117.5071	0.4500	0.0000	0.9000	170.8494

total: 539.5531

	Jun	Jul	Aug	
Solar gains	573	540	473	(P4)
Internal gains	468	449	458	
Total summer gains	1042	989	931	(P5)

Summer gain/loss ratio	2.86	2.72	2.56	(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	19.11	20.87	20.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight