

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 91			Issued on Date	29/09/2023
Assessment Reference	91 Hamblewood	Prop Type Ref	21809		
Property	9 Hickory Way, Hedge End, Southampton, SO30 0AW				
SAP Rating	88 B	DER	12.99	TER	17.48
Environmental	90 B	% DER<TER	25.70		
CO ₂ Emissions (t/year)	0.84	DFEE	46.39	TFEE	51.98
General Requirements Compliance	Pass	% DFEE<TFEE	10.74		
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk			Assessor ID	AU40-0001
Client					

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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 97 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) 17.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 46.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.48 (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 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 10.65 m², No overhang
Windows facing South: 5.50 m², No overhang
Air change rate: 0.00 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 0.12 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.039 W/m²K
Photovoltaic array 1.48 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.4800
Infiltration rate					0.2240 (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) =		0.1904 (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	0.2428	0.2380	0.2332	0.2094	0.2047	0.1809	0.1809	0.1761	0.1904	0.2047	0.2142	0.2237 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0960 (36)
Total fabric heat loss						(33) + (36) =	67.1671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Average = Sum(39)m / 12 =	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1228	20.5375	16.7022	12.6446	9.4520	7.9798	8.6224	11.2078	15.0431	19.1006	22.2933	23.7655 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	416.9532	414.6909	399.5681	375.1174	350.1269	326.2132	310.7966	317.1867	329.8566	354.5322	382.8608	404.2648 (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				10.6500	10.6334	0.4500		0.0000		0.7700	39.2396 (74)	
South				5.5000	46.7521	0.4500		0.0000		0.7700	89.0977 (78)	
Solar gains	128.3374	220.9080	313.2996	414.7556	494.6333	505.8405	481.4171	418.5351	347.3740	246.6520	154.0183	109.7007 (83)
Total gains	545.2905	635.5990	712.8676	789.8730	844.7603	832.0537	792.2137	735.7217	677.2306	601.1842	536.8791	513.9655 (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	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248
Feb	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883
Mar	0.9984	0.9961	0.9897	0.9673	0.8972	0.7471	0.5784	0.6397	0.8710	0.9798	0.9965	0.9988 (86)
Apr	19.7590	19.9111	20.1538	20.4679	20.7606	20.9346	20.9857	20.9767	20.8497	20.4755	20.0484	19.7175 (87)
May	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911 (88)
Jun	0.9978	0.9948	0.9861	0.9546	0.8570	0.6584	0.4550	0.5148	0.8061	0.9697	0.9950	0.9984 (89)
Jul	18.8574	19.0090	19.2499	19.5568	19.8256	19.9600	19.9873	19.9841	19.9048	19.5682	19.1463	18.8160 (90)
Aug	18.9788	19.1304	19.3716	19.6794	19.9514	20.0912	20.1217	20.1177	20.0320	19.6903	19.2677	18.9373 (91)
Sep	18.8288	18.9804	19.2216	19.5294	19.8014	19.9412	19.9717	19.9677	19.8820	19.5403	19.1177	18.7873 (92)
Oct												
Nov												
Dec												

8. Space heating requirement

Utilisation	0.9969	0.9929	0.9822	0.9471	0.8479	0.6535	0.4525	0.5117	0.7976	0.9634	0.9932	0.9977 (94)
Useful gains	543.6039	631.1018	700.1863	748.0979	716.2672	543.7294	358.4671	376.4453	540.1352	579.1697	533.2502	512.7756 (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	1560.5780	1512.4227	1366.4610	1141.7337	870.1991	573.7127	362.1618	383.2188	621.0619	960.3031	1290.8621	1566.8683 (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	756.6287	592.2477	495.7084	283.4178	114.5254	0.0000	0.0000	0.0000	0.0000	283.5632	545.4806	784.2450 (98)
Space heating												3855.8168 (98)
Space heating per m2												(98) / (4) = 39.9153 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4260.5711 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	756.6287	592.2477	495.7084	283.4178	114.5254	0.0000	0.0000	0.0000	0.0000	283.5632	545.4806	784.2450	(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)	836.0539	654.4173	547.7441	313.1689	126.5474	0.0000	0.0000	0.0000	0.0000	313.3296	602.7410	866.5691	(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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788	(64)
Efficiency of water heater	89.8818	89.8232	89.7012	89.4164	88.7385	87.3000	87.3000	87.3000	87.3000	89.3899	89.7650	87.3000	(216)
(217)m	89.8818	89.8232	89.7012	89.4164	88.7385	87.3000	87.3000	87.3000	87.3000	89.3899	89.7650	89.9138	(217)
Fuel for water heating, kWh/month	194.4320	170.6007	177.3261	156.5535	152.4588	135.3685	127.0657	143.4973	144.5268	162.5396	174.7855	188.7128	(219)
Water heating fuel used												1927.8673	(219)
Annual totals kWh/year													
Space heating fuel - main system												4260.5711	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												65.3345	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												140.3345	(231)
Electricity for lighting (calculated in Appendix L)												408.3563	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 597 * 1.00) =										-707.2761		-707.2761	(233)
Total delivered energy for all uses												6029.8531	(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	4260.5711	0.2160	920.2834	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1927.8673	0.2160	416.4193	(264)
Space and water heating			1336.7027	(265)
Pumps and fans	140.3345	0.5190	72.8336	(267)
Energy for lighting	408.3563	0.5190	211.9369	(268)
Energy saving/generation technologies				
PV Unit	-707.2761	0.5190	-367.0763	(269)
Total CO2, kg/year			1254.3969	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9900	(273)

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

DER		12.9900	ZC1
Total Floor Area		96.6000	
Assumed number of occupants	TFA	2.7057	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	15.3795	ZC2
CO2 emissions from cooking, equation (L16)		1.9041	ZC3
Total CO2 emissions		30.2736	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		30.2736	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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) =	0.1230 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3730 (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) =					0.3170 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.4042	0.3963	0.3884	0.3487	0.3408	0.3012	0.3012	0.2933	0.3170	0.3408	0.3567	0.3725	(22a)				
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5636	0.5694	(22b)				
													(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			16.1500	1.3258	21.4110		(27)					
ground			48.3000	0.1300	6.2790		(28a)					
external	109.0800	18.1500	90.9300	0.1800	16.3674		(29a)					
cold	48.3000		48.3000	0.1300	6.2790		(30)					
Total net area of external elements Aum(A, m2)			205.6800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		52.3364		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9860 (36)					
Total fabric heat loss						(33) + (36) =	62.3224 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.8223	Feb 46.5669	Mar 46.3166	Apr 45.1409	May 44.9210	Jun 43.8970	Jul 43.8970	Aug 43.7073	Sep 44.2914	Oct 44.9210	Nov 45.3660	Dec 45.8312 (38)
Heat transfer coeff	109.1447	108.8893	108.6390	107.4633	107.2433	106.2193	106.2193	106.0297	106.6138	107.2433	107.6883	108.1536 (39)
Average = Sum(39)m / 12 =												107.4623 (39)
HLP	Jan 1.1299	Feb 1.1272	Mar 1.1246	Apr 1.1125	May 1.1102	Jun 1.0996	Jul 1.0996	Aug 1.0976	Sep 1.1037	Oct 1.1102	Nov 1.1148	Dec 1.1196 (40)
HLP (average)												1.1124 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)
Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total = Sum(45)m =		1549.1812 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
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	50.9589	47.5852	47.1644	43.7007	45.1574	47.1644	47.5852	50.9589	49.3151	50.9589 (61)
Solar input	211.5759	186.5040	195.9182	173.9642	168.4280	148.3420	142.1229	158.4338	160.1835	182.1814	192.5547	206.5078 (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	211.5759	186.5040	195.9182	173.9642	168.4280	148.3420	142.1229	158.4338	160.1835	182.1814	192.5547	206.5078 (64)
	66.1449	58.2153	60.9387	53.9173	52.1113	45.7184	43.5304	48.7882	49.3352	56.3712	59.9559	64.4597 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1228	20.5375	16.7022	12.6446	9.4520	7.9798	8.6224	11.2078	15.0431	19.1006	22.2933	23.7655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	88.9044	86.6299	81.9068	74.8852	70.0420	63.4978	58.5086	65.5755	68.5212	75.7677	83.2721	86.6394	(72)
Total internal gains	429.3245	427.0663	411.9519	386.9159	361.2621	336.6873	321.2787	328.3293	341.6662	366.9272	395.2422	416.6401	(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					10.6500	10.6334	0.6300	0.7000	0.7700	34.6093 (74)		
South					5.5000	46.7521	0.6300	0.7000	0.7700	78.5842 (78)		
Solar gains	113.1935	194.8409	276.3302	365.8144	436.2666	446.1513	424.6099	369.1479	306.3839	217.5471	135.8442	96.7560 (83)
Total gains	542.5180	621.9072	688.2822	752.7303	797.5288	782.8386	745.8886	697.4773	648.0501	584.4742	531.0863	513.3962 (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	61.4628	61.6069	61.7488	62.4244	62.5524	63.1555	63.1555	63.2684	62.9218	62.5524	62.2940	62.0260	
alpha	5.0975	5.1071	5.1166	5.1616	5.1702	5.2104	5.2104	5.2179	5.1948	5.1702	5.1529	5.1351	
util living area	0.9985	0.9968	0.9918	0.9740	0.9157	0.7745	0.6049	0.6628	0.8867	0.9828	0.9969	0.9989	(86)
MIT	19.7500	19.8937	20.1281	20.4448	20.7385	20.9279	20.9841	20.9750	20.8421	20.4703	20.0534	19.7250	(87)
Th 2	19.9765	19.9787	19.9808	19.9907	19.9925	20.0012	20.0012	20.0028	19.9978	19.9925	19.9888	19.9849	(88)
util rest of house	0.9980	0.9956	0.9888	0.9635	0.8799	0.6875	0.4786	0.5367	0.8257	0.9739	0.9956	0.9985	(89)
MIT 2	18.3050	18.5163	18.8592	19.3217	19.7235	19.9502	19.9950	19.9918	19.8633	19.3642	18.7574	18.2744	(90)
Living area fraction	18.4995	18.7017	19.0300	19.4728	19.8601	20.0817	20.1281	20.1241	19.9950	19.5131	18.9318	18.4696	(92)
Temperature adjustment	18.4995	18.7017	19.0300	19.4728	19.8601	20.0817	20.1281	20.1241	19.9950	19.5131	18.9318	18.4696	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9969	0.9935	0.9847	0.9562	0.8742	0.6953	0.4954	0.5531	0.8255	0.9679	0.9936	0.9977	(94)
Ext temp.	540.8421	617.8638	677.7336	719.7891	697.1931	544.3196	369.5143	385.8005	534.9341	565.7207	527.6620	512.1919	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1549.7962	1502.8528	1361.2457	1136.1913	875.1160	582.2667	374.7522	394.8658	628.4870	955.8663	1274.1477	1543.3115	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	750.6619	594.7126	508.5330	299.8096	132.3747	0.0000	0.0000	0.0000	0.0000	290.2683	537.4697	767.1530	(98)
												3880.9829	(98)
												40.1758	(99)

8c. Space cooling requirement

Not applicable

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

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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													4155.2279 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	750.6619	594.7126	508.5330	299.8096	132.3747	0.0000	0.0000	0.0000	0.0000	290.2683	537.4697	767.1530	(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)	803.7065	636.7372	544.4679	320.9953	141.7288	0.0000	0.0000	0.0000	0.0000	310.7798	575.4494	821.3630	(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	211.5759	186.5040	195.9182	173.9642	168.4280	148.3420	142.1229	158.4338	160.1835	182.1814	192.5547	206.5078	(64)
Efficiency of water heater	87.9672	87.7646	87.3446	86.4092	84.4523	80.3000	80.3000	80.3000	80.3000	86.2183	87.4972	88.0511	(217)
Fuel for water heating, kWh/month	240.5168	212.5048	224.3048	201.3259	199.4357	184.7347	176.9900	197.3023	199.4813	211.3025	220.0695	234.5319	(219)
Water heating fuel used												2502.5002	(219)
Annual totals kWh/year													
Space heating fuel - main system												4155.2279	(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)												408.3563	(232)
Total delivered energy for all uses												7141.0845	(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	4155.2279	0.2160	897.5292 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2502.5002	0.2160	540.5400 (264)
Space and water heating			1438.0693 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	408.3563	0.5190	211.9369 (268)
Total CO2, kg/m2/year			1688.9312 (272)
Emissions per m2 for space and water heating			14.8868 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1940 (272b)
Emissions per m2 for pumps and fans			0.4030 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8868 * 1.00) + 2.1940 + 0.4030, rounded to 2 d.p.			17.4800 (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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) = 0.1230 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3470 (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) =	0.2949 (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	0.3761	0.3687	0.3613	0.3244	0.3171	0.2802	0.2802	0.2728	0.2949	0.3171	0.3318	0.3466 (22b)
Effective ac	0.5707	0.5680	0.5653	0.5526	0.5503	0.5393	0.5393	0.5372	0.5435	0.5503	0.5550	0.5601 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.0960 (36)
Total fabric heat loss (33) + (36) = 67.1671 (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	45.9374	45.7164	45.4998	44.4823	44.2919	43.4057	43.4057	43.2416	43.7471	44.2919	44.6770	45.0797 (38)
Heat transfer coeff	113.1045	112.8835	112.6669	111.6494	111.4590	110.5728	110.5728	110.4087	110.9142	111.4590	111.8441	112.2468 (39)
Average = Sum(39)m / 12 =												111.6485 (39)
HLP	1.1709	1.1686	1.1663	1.1558	1.1538	1.1446	1.1446	1.1429	1.1482	1.1538	1.1578	1.1620 (40)
HLP (average)												1.1558 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total = Sum(45)m =		1549.1812 (45)

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1311	29.8513	30.8038	26.8555	25.7685	22.2363	20.6052	23.6447	23.9271	27.8848	30.4384	33.0541 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1228	20.5375	16.7022	12.6446	9.4520	7.9798	8.6224	11.2078	15.0431	19.1006	22.2933	23.7655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	45.8751	44.4215	41.4030	37.2994	34.6351	30.8837	27.6951	31.7806	33.2321	37.4795	42.2756	44.4276	(72)
Total internal gains	383.2952	381.8579	368.4481	346.3301	322.8552	301.0732	287.4652	291.5344	303.3772	325.6390	351.2456	371.4283	(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	10.6500				10.6334	0.4500		0.0000		0.7700		39.2396 (74)
South	5.5000				46.7521	0.4500		0.0000		0.7700		89.0977 (78)

Solar gains	128.3374	220.9080	313.2996	414.7556	494.6333	505.8405	481.4171	418.5351	347.3740	246.6520	154.0183	109.7007 (83)
Total gains	511.6326	602.7659	681.7477	761.0857	817.4886	806.9137	768.8823	710.0695	650.7512	572.2910	505.2639	481.1290 (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	58.2389	58.3529	58.4651	58.9979	59.0987	59.5724	59.5724	59.6609	59.3890	59.0987	58.8952	58.6840	
alpha	4.8826	4.8902	4.8977	4.9332	4.9399	4.9715	4.9715	4.9774	4.9593	4.9399	4.9263	4.9123	
util living area	0.9988	0.9970	0.9919	0.9734	0.9135	0.7736	0.6072	0.6708	0.8919	0.9843	0.9973	0.9991	(86)
MIT	19.6462	19.8043	20.0585	20.3989	20.7144	20.9176	20.9806	20.9689	20.8176	20.4127	19.9652	19.6172	(87)
Th 2	19.9434	19.9452	19.9470	19.9555	19.9571	19.9645	19.9645	19.9659	19.9617	19.9571	19.9539	19.9505	(88)
util rest of house	0.9983	0.9959	0.9889	0.9626	0.8768	0.6850	0.4770	0.5409	0.8318	0.9760	0.9962	0.9988	(89)
MIT 2	18.7068	18.8659	19.1202	19.4612	19.7565	19.9246	19.9593	19.9564	19.8543	19.4797	19.0338	18.6836	(90)
Living area fraction									fLA = Living area / (4) =			0.1346	(91)
MIT	18.8332	18.9922	19.2465	19.5874	19.8854	20.0582	20.0968	20.0927	19.9839	19.6053	19.1591	18.8092	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8332	18.9922	19.2465	19.5874	19.8854	20.0582	20.0968	20.0927	19.9839	19.6053	19.1591	18.8092	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9977	0.9946	0.9862	0.9577	0.8738	0.6939	0.4945	0.5581	0.8334	0.9722	0.9950	0.9983	(94)
Ext temp.	510.4507	599.5022	672.3134	728.8638	714.3320	559.9297	380.2392	396.3201	542.3223	556.3942	502.7502	480.3053	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1643.7761	1590.7765	1436.1032	1193.2395	912.3403	603.5311	386.6483	407.7042	652.6101	1003.7207	1348.7391	1639.8372	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	843.1941	666.1363	568.2596	334.3505	147.3182	0.0000	0.0000	0.0000	0.0000	332.8109	609.1120	862.6917	(98)
Space heating per m2												4363.8733	(98)
										(98) / (4) =		45.1747	(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	1039.3843	818.2387	839.1060	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8354	0.9039	0.8736	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	868.2993	739.6466	733.0653	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1046.5835	999.9442	933.1115	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	128.3646	193.6614	148.8344	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												470.8603 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	32.0912	48.4153	37.2086	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												117.7151 (107)
Space cooling per m2												1.2186 (108)
Energy for space heating												45.1747 (99)
Energy for space cooling												1.2186 (108)
Total												46.3933 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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) =	0.1230 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3730 (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) =					0.3170 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.4042	0.3963	0.3884	0.3487	0.3408	0.3012	0.3012	0.2933	0.3170	0.3408	0.3567	0.3725	(22a)				
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5636	0.5694	(22b)				
													(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			16.1500	1.3258	21.4110		(27)					
ground			48.3000	0.1300	6.2790		(28a)					
external	109.0800	18.1500	90.9300	0.1800	16.3674		(29a)					
cold	48.3000		48.3000	0.1300	6.2790		(30)					
Total net area of external elements Aum(A, m2)			205.6800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		52.3364		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9860 (36)					
Total fabric heat loss						(33) + (36) =	62.3224 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.8223	Feb 46.5669	Mar 46.3166	Apr 45.1409	May 44.9210	Jun 43.8970	Jul 43.8970	Aug 43.7073	Sep 44.2914	Oct 44.9210	Nov 45.3660	Dec 45.8312 (38)
Heat transfer coeff	109.1447	108.8893	108.6390	107.4633	107.2433	106.2193	106.2193	106.0297	106.6138	107.2433	107.6883	108.1536 (39)
Average = Sum(39)m / 12 =												107.4623 (39)
HLP	Jan 1.1299	Feb 1.1272	Mar 1.1246	Apr 1.1125	May 1.1102	Jun 1.0996	Jul 1.0996	Aug 1.0976	Sep 1.1037	Oct 1.1102	Nov 1.1148	Dec 1.1196 (40)
HLP (average)												1.1124 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan 108.3075	Feb 104.3691	Mar 100.4306	Apr 96.4922	May 92.5537	Jun 88.6153	Jul 88.6153	Aug 92.5537	Sep 96.4922	Oct 100.4306	Nov 104.3691	Dec 108.3075 (44)
Energy conte	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Energy content (annual)										Total = Sum(45)m =		1549.1812 (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)
	34.1311	29.8513	30.8038	26.8555	25.7685	22.2363	20.6052	23.6447	23.9271	27.8848	30.4384	33.0541 (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	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	135.2872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1228	20.5375	16.7022	12.6446	9.4520	7.9798	8.6224	11.2078	15.0431	19.1006	22.2933	23.7655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.7111	253.3127	246.7568	232.7999	215.1820	198.6235	187.5615	184.9599	191.5159	205.4727	223.0906	239.6491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	36.5287	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	45.8751	44.4215	41.4030	37.2994	34.6351	30.8837	27.6951	31.7806	33.2321	37.4795	42.2756	44.4276	(72)
Total internal gains	383.2952	381.8579	368.4481	346.3301	322.8552	301.0732	287.4652	291.5344	303.3772	325.6390	351.2456	371.4283	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	10.6500				10.6334		0.6300		0.7000		0.7700		34.6093 (74)	
South	5.5000				46.7521		0.6300		0.7000		0.7700		78.5842 (78)	

Solar gains	113.1935	194.8409	276.3302	365.8144	436.2666	446.1513	424.6099	369.1479	306.3839	217.5471	135.8442	96.7560 (83)		
Total gains	496.4888	576.6988	644.7784	712.1445	759.1219	747.2246	712.0751	660.6824	609.7611	543.1860	487.0898	468.1844 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	61.4628	61.6069	61.7488	62.4244	62.5524	63.1555	63.1555	63.2684	62.9218	62.5524	62.2940	62.0260		
alpha	5.0975	5.1071	5.1166	5.1616	5.1702	5.2104	5.2104	5.2179	5.1948	5.1702	5.1529	5.1351		
util living area	0.9990	0.9977	0.9939	0.9793	0.9285	0.7969	0.6292	0.6915	0.9061	0.9874	0.9979	0.9993	(86)	
MIT	19.7054	19.8502	20.0873	20.4098	20.7135	20.9172	20.9810	20.9697	20.8204	20.4330	20.0110	19.6811	(87)	
Th 2	19.9765	19.9787	19.9808	19.9907	19.9925	20.0012	20.0012	20.0028	19.9978	19.9925	19.9888	19.9849	(88)	
util rest of house	0.9987	0.9969	0.9915	0.9706	0.8964	0.7120	0.5000	0.5637	0.8512	0.9807	0.9971	0.9991	(89)	
MIT 2	18.7908	18.9370	19.1748	19.5006	19.7880	19.9603	19.9960	19.9934	19.8902	19.5277	19.1059	18.7731	(90)	
Living area fraction														
MIT	18.9139	19.0599	19.2976	19.6229	19.9126	20.0890	20.1286	20.1248	20.0154	19.6496	19.2277	18.8953	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9139	19.0599	19.2976	19.6229	19.9126	20.0890	20.1286	20.1248	20.0154	19.6496	19.2277	18.8953	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	495.5963	574.3146	637.9343	688.2226	678.1244	538.2870	368.4178	383.6379	519.7396	530.9446	485.1899	467.5629	(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	1595.0251	1541.8607	1390.3143	1152.3216	880.7428	583.0420	374.8027	394.9378	630.6625	970.5054	1306.0085	1589.3515	(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	817.9750	650.1910	559.7708	334.1513	150.7481	0.0000	0.0000	0.0000	0.0000	327.0332	590.9894	834.6107	(98)	
Space heating												4265.4695	(98)	
Space heating per m2												44.1560	(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	998.4619	786.0232	805.8259	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8296	0.9017	0.8718	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	828.3695	708.7925	702.5206	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	976.8169	933.5461	875.3863	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	106.8821	167.2167	128.6120	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												402.7109	(104)	
Cooled fraction												1.0000	(105)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	26.7205	41.8042	32.1530	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											100.6777 (107)
Space cooling per m2											1.0422 (108)
Energy for space heating											44.1560 (99)
Energy for space cooling											1.0422 (108)
Total											45.1982 (109)
Target Fabric Energy Efficiency (TFEE)											52.0 (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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.4800
Infiltration rate					0.2240 (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) =		0.1904 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.2237	0.2094	0.2094	0.1904	0.1952	0.1856	0.1856	0.1809	0.1809	0.1952	0.1904	0.1952 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0960 (36)
Total fabric heat loss						(33) + (36) =	67.1671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Average = Sum(39)m / 12 =	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (65)
												1715 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8071	51.3437	41.7555	31.6116	23.6301	19.9495	21.5561	28.0195	37.6077	47.7516	55.7331	59.4137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	619.5909	614.7320	590.6272	553.2159	514.7590	480.4813	460.5803	469.5669	491.2189	528.8550	570.6500	602.4180 (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			10.6500		13.4684		0.4500		0.0000		0.7700		49.7015 (74)	
South			5.5000		56.5862		0.4500		0.0000		0.7700		107.8392 (78)	
Solar gains	157.5407	231.6037	337.1455	452.8723	511.5631	579.9957	529.9528	478.5448	393.0094	279.7683	188.5972	127.3978 (83)		
Total gains	777.1316	846.3357	927.7727	1006.0882	1026.3222	1060.4770	990.5331	948.1117	884.2282	808.6234	759.2472	729.8158 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248
alpha	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883
util living area	0.9885	0.9817	0.9591	0.8921	0.7475	0.5077	0.3566	0.3612	0.6464	0.8971	0.9745	0.9910 (86)
MIT	20.1200	20.2249	20.4542	20.7285	20.9191	20.9907	20.9988	20.9988	20.9703	20.7710	20.4120	20.0860 (87)
Th 2	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911 (88)
util rest of house	0.9847	0.9757	0.9457	0.8576	0.6771	0.4116	0.2483	0.2481	0.5447	0.8548	0.9646	0.9879 (89)
MIT 2	19.2158	19.3186	19.5405	19.7929	19.9461	19.9882	19.9909	19.9910	19.9797	19.8357	19.5032	19.1825 (90)
Living area fraction	19.3375	19.4406	19.6635	19.9188	20.0770	20.1231	20.1266	20.1266	20.1130	19.9616	19.6255	19.3041 (92)
MIT	19.3375	19.4406	19.6635	19.9188	20.0770	20.1231	20.1266	20.1266	20.1130	19.9616	19.6255	19.3041 (92)
Temperature adjustment	19.1875	19.2906	19.5135	19.7688	19.9270	19.9731	19.9766	19.9766	19.9630	19.8116	19.4755	-0.1500
adjusted MIT	19.1875	19.2906	19.5135	19.7688	19.9270	19.9731	19.9766	19.9766	19.9630	19.8116	19.4755	19.1541 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9807	0.9703	0.9377	0.8487	0.6722	0.4099	0.2467	0.2464	0.5417	0.8456	0.9579	0.9844 (94)
Ext temp.	762.0973	821.1969	869.9313	853.8975	689.8532	434.6515	244.3845	233.6507	478.9662	683.8070	727.2513	718.4671 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1459.4742	1427.5817	1279.6653	1038.5546	733.3126	437.5050	244.5338	233.7927	490.1233	828.3260	1168.1705	1445.1464 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	518.8484	407.4906	304.8421	132.9531	32.3338	0.0000	0.0000	0.0000	0.0000	107.5221	317.4618	540.6494 (98)
RHI space heating demand												2362.1014 (98)
												2362 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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					4.4800
Infiltration rate					0.2240 (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) =		0.1904 (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	0.2428	0.2380	0.2332	0.2094	0.2047	0.1809	0.1809	0.1761	0.1904	0.2047	0.2142	0.2237 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0960 (36)
Total fabric heat loss						(33) + (36) =	67.1671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Average = Sum(39)m / 12 =	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1549.1812 (45)
	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (65)
								Total per year (kWh/year) =	Sum (64)m =			1714.7548 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	57.8071	51.3437	41.7555	31.6116	23.6301	19.9495	21.5561	28.0195	37.6077	47.7516	55.7331	59.4137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402 (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)												
	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)												
	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	619.5909	614.7320	590.6272	553.2159	514.7590	480.4813	460.5803	469.5669	491.2189	528.8550	570.6500	602.4180 (73)

6. Solar gains

[Jan]		Area	Solar flux									
		m ²	Table 6a	g	Specific data	Specific data	FF	Access				Gains
			W/m ²	Table 6b	or Table 6b	or Table 6c		factor				W
								Table 6d				
North		10.6500	10.6334	0.4500			0.0000	0.7700				39.2396 (74)
South		5.5000	46.7521	0.4500			0.0000	0.7700				89.0977 (78)
Solar gains	128.3374	220.9080	313.2996	414.7556	494.6333	505.8405	481.4171	418.5351	347.3740	246.6520	154.0183	109.7007 (83)
Total gains	747.9283	835.6401	903.9268	967.9715	1009.3924	986.3218	941.9974	888.1020	838.5928	775.5070	724.6683	712.1188 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248
alpha	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883
util living area	0.9932	0.9871	0.9727	0.9317	0.8314	0.6591	0.4941	0.5435	0.7802	0.9465	0.9868	0.9946 (86)
MIT	19.9561	20.1016	20.3263	20.6048	20.8413	20.9629	20.9929	20.9887	20.9137	20.6195	20.2273	19.9111 (87)
Th 2	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911 (88)
util rest of house	0.9910	0.9831	0.9639	0.9091	0.7794	0.5703	0.3848	0.4308	0.7007	0.9240	0.9820	0.9930 (89)
MIT 2	19.0532	19.1970	19.4171	19.6819	19.8879	19.9746	19.9893	19.9880	19.9462	19.7009	19.3225	19.0087 (90)
Living area fraction									fLA = Living area / (4) =			0.1346 (91)
MIT	19.1747	19.3187	19.5395	19.8061	20.0162	20.1076	20.1244	20.1226	20.0764	19.8245	19.4443	19.1301 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0247	19.1687	19.3895	19.6561	19.8662	19.9576	19.9744	19.9726	19.9264	19.6745	19.2943	18.9801 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9882	0.9787	0.9571	0.9001	0.7720	0.5672	0.3829	0.4286	0.6949	0.9150	0.9774	0.9906 (94)
Useful gains	739.1099	817.8414	865.1906	871.2299	779.2888	559.4215	360.7192	380.6809	582.7627	709.6050	708.2962	705.4246 (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												
	1581.6270	1532.6448	1384.4983	1155.3439	877.1568	575.4812	362.4529	383.7476	625.8318	974.7212	1309.8275	1587.5768 (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												
	626.8327	480.3479	386.3649	204.5621	72.8138	0.0000	0.0000	0.0000	0.0000	197.2464	433.1025	656.3213 (98)
Space heating												3057.5915 (98)
Space heating per m2										(98) / (4) =		31.6521 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3378.5542 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.8327	480.3479	386.3649	204.5621	72.8138	0.0000	0.0000	0.0000	0.0000	197.2464	433.1025	656.3213	(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)	692.6329	530.7711	426.9226	226.0354	80.4572	0.0000	0.0000	0.0000	0.0000	217.9518	478.5663	725.2169	(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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788	(64)
Efficiency of water heater	89.7825	89.7047	89.5428	89.1720	88.3936	87.3000	87.3000	87.3000	87.3000	89.1145	89.6264	87.3000	(216)
(217)m	89.7825	89.7047	89.5428	89.1720	88.3936	87.3000	87.3000	87.3000	87.3000	89.1145	89.6264	89.8236	(217)
Fuel for water heating, kWh/month	194.6470	170.8260	177.6399	156.9825	153.0536	135.3685	127.0657	143.4973	144.5268	163.0420	175.0558	188.9022	(219)
Water heating fuel used	1930.6073											1930.6073	(219)
Annual totals kWh/year													
Space heating fuel - main system												3378.5542	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												65.3345	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												140.3345	(231)
Electricity for lighting (calculated in Appendix L)												408.3563	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 597 * 1.00) =										-707.2761		-707.2761	(233)
Total delivered energy for all uses												5150.5762	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3378.5542	3.4800	117.5737	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1930.6073	3.4800	67.1851	(247)
Mechanical ventilation fans	65.3345	13.1900	8.6176	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	408.3563	13.1900	53.8622	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-707.2761	13.1900	-93.2897	(252)
Total energy cost			283.8414	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)				
		$[(255) \times (256)] / [(4) + 45.0] =$	0.8419	(257)
SAP value			88.2555	
SAP rating (Section 12)			88	(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	3378.5542	0.2160	729.7677	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1930.6073	0.2160	417.0112	(264)
Space and water heating			1146.7789	(265)
Pumps and fans	140.3345	0.5190	72.8336	(267)
Energy for lighting	408.3563	0.5190	211.9369	(268)
Energy saving/generation technologies				
PV Unit	-707.2761	0.5190	-367.0763	(269)
Total kg/year			1064.4731	(272)
CO2 emissions per m2			11.0200	(273)
EI value			89.9266	
EI rating			90	(274)
EI band			B	

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8870 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4800
Infiltration rate												0.2240 (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) =	0.1904 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2237	0.2094	0.2094	0.1904	0.1952	0.1856	0.1856	0.1809	0.1809	0.1952	0.1904	0.1952 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0960 (36)
Total fabric heat loss						(33) + (36) =	67.1671 (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	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Heat transfer coeff	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131 (39)
Average = Sum(39)m / 12 =												107.4131 (39)
HLP	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119 (40)
HLP (average)												1.1119 (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	2.7057 (42)
Average daily hot water use (litres/day)	98.4614 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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

Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1549.1812 (45)
	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (65)
								Total per year (kWh/year) =	Sum (64)m =			1714.7548 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	57.8071	51.3437	41.7555	31.6116	23.6301	19.9495	21.5561	28.0195	37.6077	47.7516	55.7331	59.4137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402 (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)												
	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)												
	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	619.5909	614.7320	590.6272	553.2159	514.7590	480.4813	460.5803	469.5669	491.2189	528.8550	570.6500	602.4180 (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			10.6500		13.4684		0.4500		0.0000		0.7700		49.7015 (74)	
South			5.5000		56.5862		0.4500		0.0000		0.7700		107.8392 (78)	
Solar gains	157.5407	231.6037	337.1455	452.8723	511.5631	579.9957	529.9528	478.5448	393.0094	279.7683	188.5972	127.3978 (83)		
Total gains	777.1316	846.3357	927.7727	1006.0882	1026.3222	1060.4770	990.5331	948.1117	884.2282	808.6234	759.2472	729.8158 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248
alpha	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883
util living area	0.9885	0.9817	0.9591	0.8921	0.7475	0.5077	0.3566	0.3612	0.6464	0.8971	0.9745	0.9910 (86)
MIT	20.1200	20.2249	20.4542	20.7285	20.9191	20.9907	20.9988	20.9988	20.9703	20.7710	20.4120	20.0860 (87)
Th 2	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911 (88)
util rest of house	0.9847	0.9757	0.9457	0.8576	0.6771	0.4116	0.2483	0.2481	0.5447	0.8548	0.9646	0.9879 (89)
MIT 2	19.2158	19.3186	19.5405	19.7929	19.9461	19.9882	19.9909	19.9910	19.9797	19.8357	19.5032	19.1825 (90)
Living area fraction									fLA =	Living area / (4) =		0.1346 (91)
MIT	19.3375	19.4406	19.6635	19.9188	20.0770	20.1231	20.1266	20.1266	20.1130	19.9616	19.6255	19.3041 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1875	19.2906	19.5135	19.7688	19.9270	19.9731	19.9766	19.9766	19.9630	19.8116	19.4755	19.1541 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9807	0.9703	0.9377	0.8487	0.6722	0.4099	0.2467	0.2464	0.5417	0.8456	0.9579	0.9844 (94)
Useful gains	762.0973	821.1969	869.9313	853.8975	689.8532	434.6515	244.3845	233.6507	478.9662	683.8070	727.2513	718.4671 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1459.4742	1427.5817	1279.6653	1038.5546	733.3126	437.5050	244.5338	233.7927	490.1233	828.3260	1168.1705	1445.1464 (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	518.8484	407.4906	304.8421	132.9531	32.3338	0.0000	0.0000	0.0000	0.0000	107.5221	317.4618	540.6494 (98)
Space heating												2362.1014 (98)
Space heating per m2										(98) / (4) =		24.4524 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2610.0567 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	518.8484	407.4906	304.8421	132.9531	32.3338	0.0000	0.0000	0.0000	0.0000	107.5221	317.4618	540.6494	(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)	573.3132	450.2658	336.8421	146.9095	35.7279	0.0000	0.0000	0.0000	0.0000	118.8090	350.7866	597.4027	(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	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788	(64)
Efficiency of water heater	89.6718	89.6024	89.3767	88.8300	87.8995	87.3000	87.3000	87.3000	87.3000	88.6329	89.4159	87.3000	(216)
(217)m	89.6718	89.6024	89.3767	88.8300	87.8995	87.3000	87.3000	87.3000	87.3000	88.6329	89.4159	89.7145	(217)
Fuel for water heating, kWh/month	194.8873	171.0211	177.9701	157.5869	153.9139	135.3685	127.0657	143.4973	144.5268	163.9279	175.4678	189.1321	(219)
Water heating fuel used												1934.3652	(219)
Annual totals kWh/year													
Space heating fuel - main system												2610.0567	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												65.3345	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												140.3345	(231)
Electricity for lighting (calculated in Appendix L)												408.3563	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 696 * 1.00) =											-824.4444	-824.4444	(233)
Total delivered energy for all uses												4268.6683	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2610.0567	10.2300	267.0088 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1934.3652	10.2300	197.8856 (247)
Mechanical ventilation fans	65.3345	36.7200	23.9908 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	408.3563	36.7200	149.9484 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-824.4444	36.7200	-302.7360 (252)
Total energy cost			466.6376 (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	2610.0567	0.2160	563.7723 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1934.3652	0.2160	417.8229 (264)
Space and water heating			981.5951 (265)
Pumps and fans	140.3345	0.5190	72.8336 (267)
Energy for lighting	408.3563	0.5190	211.9369 (268)
Energy saving/generation technologies			
PV Unit	-824.4444	0.5190	-427.8867 (269)
Total kg/year			838.4790 (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	2610.0567	1.2200	3184.2692 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1934.3652	1.2200	2359.9255 (264)
Space and water heating			5544.1948 (265)
Pumps and fans	140.3345	3.0700	430.8270 (267)
Energy for lighting	408.3563	3.0700	1253.6539 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-824.4444	3.0700	-2531.0445 (269)
Primary energy kWh/year			4697.6312 (272)
Primary energy kWh/m2/year			48.6297 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 85	-193 kg (23.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£85 1.99 kg/m²	B 89	A 92
Total Savings	£85 1.99 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			A 92

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£201	£220	-£19
Mains gas	£568	£464	£104
Space heating	£422	£422	£0
Water heating	£198	£113	£85
Lighting	£150	£150	£0
Generated (PV)	-£303	-£303	£0
Total cost of fuels	£466	£381	£86
Total cost of uses	£467	£382	£85
Delivered energy	44 kWh/m²	34 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	49 kWh/m²	37 kWh/m²	11 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	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9150 (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					4.4800
Infiltration rate					0.2240 (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) =	0.1904 (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	0.2428	0.2380	0.2332	0.2094	0.2047	0.1809	0.1809	0.1761	0.1904	0.2047	0.2142	0.2237 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0960 (36)
Total fabric heat loss							(33) + (36) = 67.1671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460	40.2460 (38)
Average = Sum(39)m / 12 =	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119	1.1119 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1549.1812 (45)
	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1707 (H8)
Utilisation factor												0.5744 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.4614 (H14)
Volume ratio Veff/V												0.7617 (H15)
Solar storage volume factor												0.9456 (H16)
Solar input	-25.1149	-41.9096	-71.3769	-95.6591	-118.1787	-116.1885	-114.6531	-100.1729	-78.4555	-53.5759	-29.7899	-866.0921 (H17)
Solar input (sum of months) = Sum (63)m =												-21.0169 (63)
Output from w/h	149.6440	111.3294	87.6869	44.3254	17.1108	1.9881	0.0000	25.1002	47.7164	91.7181	127.1062	148.6619 (64)
Total per year (kWh/year) = Sum (64)m =												852.3875 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8071	51.3437	41.7555	31.6116	23.6301	19.9495	21.5561	28.0195	37.6077	47.7516	55.7331	59.4137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402 (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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297 (71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641 (72)
Total internal gains	619.5909	614.7320	590.6272	553.2159	514.7590	480.4813	460.5803	469.5669	491.2189	528.8550	570.6500	602.4180 (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				10.6500	10.6334	0.4500		0.0000		0.7700		39.2396 (74)
South				5.5000	46.7521	0.4500		0.0000		0.7700		89.0977 (78)

Solar gains	128.3374	220.9080	313.2996	414.7556	494.6333	505.8405	481.4171	418.5351	347.3740	246.6520	154.0183	109.7007 (83)
Total gains	747.9283	835.6401	903.9268	967.9715	1009.3924	986.3218	941.9974	888.1020	838.5928	775.5070	724.6683	712.1188 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248
alpha	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883
util living area	0.9932	0.9871	0.9727	0.9317	0.8314	0.6591	0.4941	0.5435	0.7802	0.9465	0.9868	0.9946 (86)
MIT	19.9561	20.1016	20.3263	20.6048	20.8413	20.9629	20.9929	20.9887	20.9137	20.6195	20.2273	19.9111 (87)
Th 2	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911 (88)
util rest of house	0.9910	0.9831	0.9639	0.9091	0.7794	0.5703	0.3848	0.4308	0.7007	0.9240	0.9820	0.9930 (89)
MIT 2	19.0532	19.1970	19.4171	19.6819	19.8879	19.9746	19.9893	19.9880	19.9462	19.7009	19.3225	19.0087 (90)
Living area fraction									fLA = Living area / (4) =			0.1346 (91)
MIT	19.1747	19.3187	19.5395	19.8061	20.0162	20.1076	20.1244	20.1226	20.0764	19.8245	19.4443	19.1301 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0247	19.1687	19.3895	19.6561	19.8662	19.9576	19.9744	19.9726	19.9264	19.6745	19.2943	18.9801 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9787	0.9571	0.9001	0.7720	0.5672	0.3829	0.4286	0.6949	0.9150	0.9774	0.9906	(94)
Useful gains	739.1099	817.8414	865.1906	871.2299	779.2888	559.4215	360.7192	380.6809	582.7627	709.6050	708.2962	705.4246	(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	1581.6270	1532.6448	1384.4983	1155.3439	877.1568	575.4812	362.4529	383.7476	625.8318	974.7212	1309.8275	1587.5768	(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	626.8327	480.3479	386.3649	204.5621	72.8138	0.0000	0.0000	0.0000	0.0000	197.2464	433.1025	656.3213	(98)
Space heating												3057.5915	(98)
Space heating per m2											(98) / (4) =	31.6521	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3378.5542	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	626.8327	480.3479	386.3649	204.5621	72.8138	0.0000	0.0000	0.0000	0.0000	197.2464	433.1025	656.3213	(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)	692.6329	530.7711	426.9226	226.0354	80.4572	0.0000	0.0000	0.0000	0.0000	217.9518	478.5663	725.2169	(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	149.6440	111.3294	87.6869	44.3254	17.1108	1.9881	0.0000	25.1002	47.7164	91.7181	127.1062	148.6619	(64)	
Efficiency of water heater	89.8652	89.8801	89.8905	89.9130	89.8732	87.3000	87.3000	87.3000	87.3000	89.4592	89.7535	89.8915	(216)	
Fuel for water heating, kWh/month	166.5206	123.8644	97.5485	49.2981	19.0389	2.2774	0.0000	28.7516	54.6579	102.5251	141.6170	165.3793	(219)	
Water heating fuel used												951.4787	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3378.5542	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)													65.3345	(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													190.3345	(231)
Electricity for lighting (calculated in Appendix L)													408.3563	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 1.48 * 597 * 1.00) =										-707.2761			-707.2761	(233)
Total delivered energy for all uses													4221.4476	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3378.5542	3.4800	117.5737	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	951.4787	3.4800	33.1115	(247)
Mechanical ventilation fans	65.3345	13.1900	8.6176	(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	408.3563	13.1900	53.8622	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-707.2761	13.1900	-93.2897	(252)
Total energy cost			256.3627	(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] =	0.7604	(257)
SAP value		89.3924	
SAP rating (Section 12)		89	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3378.5542	0.2160	729.7677 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	951.4787	0.2160	205.5194 (264)
Space and water heating			935.2871 (265)
Pumps and fans	190.3345	0.5190	98.7836 (267)
Energy for lighting	408.3563	0.5190	211.9369 (268)
Energy saving/generation technologies			
PV Unit	-707.2761	0.5190	-367.0763 (269)
Total kg/year			878.9313 (272)
CO2 emissions per m2			9.1000 (273)
EI value			91.6824
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.3000 (1b)	x 2.4500 (2b)	= 118.3350 (1b) - (3b)
First floor	48.3000 (1c)	x 2.6000 (2c)	= 125.5800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	243.9150 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4800
Infiltration rate												0.2240 (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) =	0.1904 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2237	0.2094	0.2094	0.1904	0.1952	0.1856	0.1856	0.1809	0.1809	0.1952	0.1904	0.1952 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			16.1500	1.3258	21.4110		(27)
ground			48.3000	0.1200	5.7960	75.0000	3622.4999 (28a)
external	109.0800	18.1500	90.9300	0.2700	24.5511	150.0000	13639.5003 (29a)
cold	48.3000		48.3000	0.1100	5.3130	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			205.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.0711		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			141.2000			9.0000	1270.8000 (32c)
block			26.8000			75.0000	2009.9999 (32c)
internal			48.3000			18.0000	869.4000 (32d)
internal			48.3000			9.0000	434.7000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23713.5001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.4814 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0960 (36)
Total fabric heat loss							(33) + (36) = 67.1671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.2460	Feb 40.2460	Mar 40.2460	Apr 40.2460	May 40.2460	Jun 40.2460	Jul 40.2460	Aug 40.2460	Sep 40.2460	Oct 40.2460	Nov 40.2460	Dec 40.2460 (38)
Heat transfer coeff	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131	107.4131 (39)
Average = Sum(39)m / 12 =												107.4131 (39)
HLP	Jan 1.1119	Feb 1.1119	Mar 1.1119	Apr 1.1119	May 1.1119	Jun 1.1119	Jul 1.1119	Aug 1.1119	Sep 1.1119	Oct 1.1119	Nov 1.1119	Dec 1.1119 (40)
HLP (average)												1.1119 (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												2.7057 (42)
Average daily hot water use (litres/day)												98.4614 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	108.3075	104.3691	100.4306	96.4922	92.5537	88.6153	88.6153	92.5537	96.4922	100.4306	104.3691	108.3075 (44)
Energy content (annual)	160.6169	140.4766	144.9593	126.3790	121.2637	104.6413	96.9656	111.2694	112.5983	131.2225	143.2396	155.5489 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1549.1812 (45)
	24.0925	21.0715	21.7439	18.9569	18.1896	15.6962	14.5448	16.6904	16.8897	19.6834	21.4859	23.3323 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1420	12.7624	14.1045	13.6055	14.0259	13.5353	13.9628	14.0037	13.5736	14.0715	13.6566	14.1299 (61)
Total heat required for water heating calculated for each month	174.7590	153.2390	159.0637	139.9845	135.2896	118.1767	110.9284	125.2731	126.1719	145.2940	156.8962	169.6788 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3079 (H8)
Utilisation factor												0.5345 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.4614 (H14)
Volume ratio Veff/V												0.7617 (H15)
Solar storage volume factor												0.9456 (H16)
Solar input												-900.3717 (H17)
Solar input	-29.3803	-41.7821	-72.5026	-97.5283	-113.3344	-123.2750	-116.8835	-106.5864	-83.4249	-57.6603	-34.7502	-23.2638 (63)
								Solar input (sum of months) = Sum (63)m =				-900.3717 (63)
Output from w/h	145.3787	111.4570	86.5611	42.4562	21.9552	0.0000	0.0000	18.6867	42.7469	87.6337	122.1460	146.4151 (64)
								Total per year (kWh/year) = Sum (64)m =				825.4366 (64)
Heat gains from water heating, kWh/month	56.9406	49.8991	51.7251	45.4224	43.8267	38.1771	35.7317	40.4980	40.8323	47.1494	51.0413	55.2525 (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	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	162.3446	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8071	51.3437	41.7555	31.6116	23.6301	19.9495	21.5561	28.0195	37.6077	47.7516	55.7331	59.4137	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1957	378.0787	368.2937	347.4626	321.1671	296.4531	279.9425	276.0596	285.8446	306.6756	332.9711	357.6852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	53.9402	(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)	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	-108.2297	(71)
Water heating gains (Table 5)	76.5331	74.2546	69.5230	63.0867	58.9068	53.0237	48.0265	54.4328	56.7116	63.3728	70.8907	74.2641	(72)
Total internal gains	619.5909	614.7320	590.6272	553.2159	514.7590	480.4813	460.5803	469.5669	491.2189	528.8550	570.6500	602.4180	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North				10.6500	13.4684	0.4500			0.0000	0.7700	49.7015 (74)	
South				5.5000	56.5862	0.4500			0.0000	0.7700	107.8392 (78)	

Solar gains	157.5407	231.6037	337.1455	452.8723	511.5631	579.9957	529.9528	478.5448	393.0094	279.7683	188.5972	127.3978 (83)
Total gains	777.1316	846.3357	927.7727	1006.0882	1026.3222	1060.4770	990.5331	948.1117	884.2282	808.6234	759.2472	729.8158 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248	61.3248
alpha	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883	5.0883
util living area	0.9885	0.9817	0.9591	0.8921	0.7475	0.5077	0.3566	0.3612	0.6464	0.8971	0.9745	0.9910 (86)
MIT	20.1200	20.2249	20.4542	20.7285	20.9191	20.9907	20.9988	20.9988	20.9703	20.7710	20.4120	20.0860 (87)
Th 2	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911	19.9911 (88)
util rest of house	0.9847	0.9757	0.9457	0.8576	0.6771	0.4116	0.2483	0.2481	0.5447	0.8548	0.9646	0.9879 (89)
MIT 2	19.2158	19.3186	19.5405	19.7929	19.9461	19.9882	19.9909	19.9910	19.9797	19.8357	19.5032	19.1825 (90)
Living area fraction									fLA = Living area / (4) =			0.1346 (91)
MIT	19.3375	19.4406	19.6635	19.9188	20.0770	20.1231	20.1266	20.1266	20.1130	19.9616	19.6255	19.3041 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1875	19.2906	19.5135	19.7688	19.9270	19.9731	19.9766	19.9766	19.9630	19.8116	19.4755	19.1541 (93)

FULL SAP CALCULATION PRINTOUT

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9703	0.9377	0.8487	0.6722	0.4099	0.2467	0.2464	0.5417	0.8456	0.9579	0.9844	(94)
Useful gains	762.0973	821.1969	869.9313	853.8975	689.8532	434.6515	244.3845	233.6507	478.9662	683.8070	727.2513	718.4671	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1459.4742	1427.5817	1279.6653	1038.5546	733.3126	437.5050	244.5338	233.7927	490.1233	828.3260	1168.1705	1445.1464	(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	518.8484	407.4906	304.8421	132.9531	32.3338	0.0000	0.0000	0.0000	0.0000	107.5221	317.4618	540.6494	(98)
Space heating												2362.1014	(98)
Space heating per m2											(98) / (4) =	24.4524	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2610.0567	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	518.8484	407.4906	304.8421	132.9531	32.3338	0.0000	0.0000	0.0000	0.0000	107.5221	317.4618	540.6494	(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)	573.3132	450.2658	336.8421	146.9095	35.7279	0.0000	0.0000	0.0000	0.0000	118.8090	350.7866	597.4027	(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	145.3787	111.4570	86.5611	42.4562	21.9552	0.0000	0.0000	18.6867	42.7469	87.6337	122.1460	146.4151	(64)	
Efficiency of water heater	89.7797	89.7931	89.7723	89.7041	89.1780	87.3000	87.3000	87.3000	87.3000	89.0345	89.5876	87.3000	(216)	
Fuel for water heating, kWh/month	161.9282	124.1264	96.4230	47.3292	24.6195	0.0000	0.0000	21.4052	48.9656	98.4266	136.3426	163.0483	(219)	
Water heating fuel used												922.6146	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2610.0567	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)													65.3345	(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													190.3345	(231)
Electricity for lighting (calculated in Appendix L)													408.3563	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 1.48 * 696 * 1.00) =										-824.4444			-824.4444	(233)
Total delivered energy for all uses													3306.9178	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2610.0567	10.2300	267.0088	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	922.6146	10.2300	94.3835	(247)
Mechanical ventilation fans	65.3345	36.7200	23.9908	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	408.3563	36.7200	149.9484	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-824.4444	36.7200	-302.7360	(252)
Total energy cost			381.4956	(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	2610.0567	0.2160	563.7723	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	922.6146	0.2160	199.2848	(264)
Space and water heating			763.0570	(265)
Pumps and fans	190.3345	0.5190	98.7836	(267)

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Energy for lighting	408.3563	0.5190	211.9369 (268)
Energy saving/generation technologies			
PV Unit	-824.4444	0.5190	-427.8867 (269)
Total kg/year			645.8909 (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	2610.0567	1.2200	3184.2692 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	922.6146	1.2200	1125.5898 (264)
Space and water heating			4309.8591 (265)
Pumps and fans	190.3345	3.0700	584.3270 (267)
Energy for lighting	408.3563	3.0700	1253.6539 (268)
Energy saving/generation technologies			
PV Unit	-824.4444	3.0700	-2531.0445 (269)
Primary energy kWh/year			3616.7955 (272)
Primary energy kWh/m2/year			37.4409 (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	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	245.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	321.97 (P1)
Transmission heat loss coefficient	67.17 (37)
Summer heat loss coefficient	389.13 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
South	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)
South	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	10.6500	87.1704	0.4500	0.0000	0.9000	375.9879
South	5.5000	118.5567	0.4500	0.0000	0.9000	264.0850
total:						640.0729

	Jun	Jul	Aug	
Solar gains	690	640	565	(P4)
Internal gains	477	458	467	
Total summer gains	1167	1098	1032	(P5)
Summer gain/loss ratio	3.00	2.82	2.65	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 245.5)	0.28	0.28	0.28	
Threshold temperature	18.68	20.40	20.23	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 91	Issued on Date	29/09/2023
Assessment Reference	91 Hamblewood	Prop Type Ref	21809
Property	9 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	88 B	DER	12.99
Environmental	90 B	TER	17.48
CO ₂ Emissions (t/year)	0.84	% DER<TER	25.70
General Requirements Compliance	Pass	DFEE	46.39
		TFEE	51.98
		% DFEE<TFEE	10.74
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
			AU40-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.99	kgCO ₂ /m ²	Pass
	-4.49 (-25.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.98	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.39	kWh/m ² /yr	
	-5.6 (-10.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

10.65 m², No overhang

Windows facing South

5.50 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.48 (measured in this dwelling)

Maximum

10.0

Pass

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.11	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.00	W/m ² K
Thermal bridging ψ -value	0.039	W/m ² K
Photovoltaic array	1.48	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 91	Issued on Date	29/09/2023
Assessment Reference	91 Hamblewood	Prop Type Ref	21809
Property	9 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	88 B	DER	12.99
Environmental	90 B	TER	17.48
CO ₂ Emissions (t/year)	0.84	% DER<TER	25.70
General Requirements Compliance	Pass	DFEE	46.39
		TFEE	51.98
		% DFEE<TFEE	10.74
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
			AU40-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South						
Property Tenure	Owner-occupied						
Transaction Type	Marketed sale						
Terrain Type	Suburban						
1.0 Property Type	House, Semi-Detached						
2.0 Number of Storeys	2						
3.0 Date Built	2021						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
		Heat Loss Perimeter		Internal Floor Area		Average Storey Height	
Ground Floor:		1.00 m		48.30 m ²		2.45 m	
1st Storey:		1.00 m		48.30 m ²		2.60 m	
7.0 Living Area	13.00			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	245.48			kJ/m ² K			
9.0 External Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure		0.27	150.00	109.08	90.93
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
party	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity		0.00	45.00	31.82	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
stud	Plasterboard on timber frame				9.00	141.20	
block	Dense block, plasterboard on dabs				75.00	26.80	
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cold	External Plane Roof	Plasterboard, insulated at ceiling level		0.11	9.00	48.30	48.30

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Other	9.00	48.30

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	48.30

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	48.30

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
entrance	Manufacture	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft 0.05			0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
entrance	Solid Door	[1] external	South							2.00	
front	Window	[1] external	South	None	0.00					5.50	
rear	Window	[1] external	North	None	0.00					10.65	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.70	0.300	No
Independently assessed	E3 Sill	9.00	0.015	No
Independently assessed	E4 Jamb	26.70	0.011	No
Independently assessed	E5 Ground floor (normal)	21.60	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	21.60	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	15.20	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	6.30	0.063	No
Independently assessed	E16 Corner (normal)	10.40	0.067	No
Independently assessed	E18 Party wall between dwellings	10.40	0.042	No
Independently assessed	P1 Party wall - Ground floor	6.30	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	6.30	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	6.30	0.091	No

Y-value	0.039	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.01	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.48	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500229
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	Through Wall Fan Kitchen	1
0.18	In Room Fan Other Wet Room	4

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	20	
Total number of L.E.L. fittings	20	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2106	
Flue Type	Balanced	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.48	North	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£85	B 89	