

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 93			Issued on Date	14/06/2023
Assessment Reference	plot 93 ham	Prop Type Ref	21809		
Property	21 Hickory Way, Southampton, SO30 0AW				
SAP Rating	87 B	DER	13.56	TER	17.11
Environmental	89 B	% DER<TER	20.74		
CO ₂ Emissions (t/year)	0.98	DFEE	45.42	TFEE	51.24
General Requirements Compliance	Pass	% DFEE<TFEE	11.34		
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk			Assessor ID	AU36-0001
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 101 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) 17.11 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.56 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.4 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	1.32 (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: 4.61 (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: 5.45 m², No overhang

Windows facing South: 10.75 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
Photovoltaic array 0.60 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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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					4.6100
Infiltration rate					0.2305 (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) =		0.1959 (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	0.2498	0.2449	0.2400	0.2155	0.2106	0.1861	0.1861	0.1812	0.1959	0.2106	0.2204	0.2302 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.7127		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) =	25175.3997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.2614 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8312 (36)
Total fabric heat loss						(33) + (36) =	72.5438 (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	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247 (38)
Average = Sum(39)m / 12 =	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685 (39)
HLP	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343 (40)
HLP (average)												1.1343 (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												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Energy conte	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy content (annual)	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1565.1930 (45)
	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (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	14.1460	12.7659	14.1081	13.6116	14.0315	13.5400	13.9671	14.0089	13.5790	14.0747	13.6601	14.1337 (61)
Total heat required for water heating calculated for each month	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (64)
Heat gains from water heating, kWh/month	57.4936	50.3827	52.2241	45.8582	44.2448	38.5378	36.0661	40.8817	41.2206	47.6011	51.5345	55.7880 (65)
								Total per year (kWh/year) =	Sum (64)m =			1730.8196 (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	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9786	21.2976	17.3203	13.1126	9.8018	8.2751	8.9416	11.6226	15.5998	19.8075	23.1183	24.6450 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.9343	260.6109	253.8661	239.5071	221.3816	204.3461	192.9653	190.2888	197.0336	211.3925	229.5181	246.5536 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430 (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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)	77.2764	74.9743	70.1937	63.6920	59.4688	53.5248	48.4759	54.9485	57.2509	63.9800	71.5756	74.9839 (72)
Total internal gains	426.4182	424.1116	408.6090	383.5406	357.8811	333.3749	317.6117	324.0887	337.1132	362.4090	391.4409	413.4114 (73)

6. Solar gains

[Jan]				Area	Solar flux	g	Specific data	FF				Access	Gains	
				m2	Table 6a	W/m2	or Table 6b	Specific data	or Table 6c				factor	W
													Table 6d	
North				5.4500	10.6334		0.4500		0.0000				0.7700	20.0804 (74)
South				10.7500	46.7521		0.4500		0.0000				0.7700	174.1456 (78)
Solar gains	194.2260	323.5802	428.5092	515.3499	568.9754	562.8231	543.3520	502.6013	457.9121	353.3010	231.1936	167.2178 (83)		
Total gains	620.6441	747.6918	837.1182	898.8905	926.8565	896.1979	860.9636	826.6900	795.0253	715.7099	622.6346	580.6292 (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	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392
alpha	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693
util living area	0.9978	0.9939	0.9844	0.9579	0.8876	0.7418	0.5688	0.6123	0.8329	0.9684	0.9948	0.9984 (86)
MIT	19.7904	19.9705	20.2175	20.5090	20.7730	20.9360	20.9865	20.9805	20.8800	20.5341	20.0904	19.7428 (87)
Th 2	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729 (88)
util rest of house	0.9970	0.9918	0.9789	0.9420	0.8444	0.6512	0.4445	0.4880	0.7587	0.9534	0.9927	0.9978 (89)
MIT 2	18.8729	19.0519	19.2961	19.5786	19.8185	19.9430	19.9694	19.9673	19.9077	19.6070	19.1721	18.8253 (90)
Living area fraction									fLA =	Living area / (4) =		0.1287 (91)
MIT	18.9910	19.1701	19.4147	19.6983	19.9414	20.0708	20.1003	20.0977	20.0329	19.7263	19.2903	18.9434 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8410	19.0201	19.2647	19.5483	19.7914	19.9208	19.9503	19.9477	19.8829	19.5763	19.1403	18.7934 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9891	0.9738	0.9336	0.8353	0.6461	0.4417	0.4847	0.7510	0.9456	0.9902	0.9969 (94)
Useful gains	618.0276	739.5774	815.2135	839.2457	774.2106	579.0083	380.2745	400.7306	597.0616	676.7464	616.5290	578.8472 (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	1665.9387	1617.7227	1462.4269	1219.9649	927.0168	609.5967	383.8437	406.4593	662.5361	1028.4005	1379.4350	1671.9473 (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	779.6458	590.1136	481.5268	274.1178	113.6878	0.0000	0.0000	0.0000	0.0000	261.6306	549.2924	813.2665 (98)
Space heating												3863.2813 (98)
Space heating per m2										(98) / (4) =		38.2503 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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												4268.8192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	779.6458	590.1136	481.5268	274.1178	113.6878	0.0000	0.0000	0.0000	0.0000	261.6306	549.2924	813.2665 (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)	861.4871	652.0592	532.0738	302.8926	125.6219	0.0000	0.0000	0.0000	0.0000	289.0946	606.9529	898.6370 (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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (64)
Efficiency of water heater (217)m	89.8920	89.8162	89.6780	89.3856	88.7253	87.3000	87.3000	87.3000	87.3000	89.3239	89.7636	87.3000 (216)
Fuel for water heating, kWh/month	196.2612	172.2344	179.0468	158.0756	153.9003	136.6126	128.2186	144.8205	145.8661	164.1817	176.4414	190.4782 (219)
Water heating fuel used												1946.1374 (219)
Annual totals kWh/year												
Space heating fuel - main system												4268.8192 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)												
mechanical ventilation fans (SFP = 0.2164)												67.2516 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												142.2516 (231)
Electricity for lighting (calculated in Appendix L)												423.4691 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.60 * 1068 * 1.00) =												-512.6739 (233)
Total delivered energy for all uses												6268.0035 (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	4268.8192	0.2160	922.0649 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.1374	0.2160	420.3657 (264)
Space and water heating			1342.4306 (265)
Pumps and fans	142.2516	0.5190	73.8286 (267)
Energy for lighting	423.4691	0.5190	219.7805 (268)
Energy saving/generation technologies			
PV Unit	-512.6739	0.5190	-266.0777 (269)
Total CO2, kg/year			1369.9620 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5600 (273)

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

DER			13.5600 ZC1
Total Floor Area		TFA	101.0000
Assumed number of occupants		N	2.7486
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.1333 ZC2
CO2 emissions from cooking, equation (L16)			1.8313 ZC3
Total CO2 emissions			30.5247 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			30.5247 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1571 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.4071	(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) =	0.3460 (21)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4411	0.4325	0.4238	0.3806	0.3719	0.3287	0.3287	0.3200	0.3460	0.3719	0.3892	0.4065 (22b)
Effective ac	0.5973	0.5935	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5826 (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			4.0000	1.0000	4.0000		(26)					
TER Opening Type (Uw = 1.40)			16.2000	1.3258	21.4773		(27)					
ground			52.7000	0.1300	6.8510		(28a)					
external	116.9200	20.2000	96.7200	0.1800	17.4096		(29a)					
cd	52.7000		52.7000	0.1300	6.8510		(30)					
Total net area of external elements Aum(A, m2)			222.3200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		56.5889		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0410 (36)					
Total fabric heat loss						(33) + (36) =	67.6299 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.2029	Feb 49.8853	Mar 49.5741	Apr 48.1120	May 47.8384	Jun 46.5650	Jul 46.5650	Aug 46.3292	Sep 47.0555	Oct 47.8384	Nov 48.3918	Dec 48.9704 (38)
Heat transfer coeff	117.8328	117.5152	117.2039	115.7418	115.4683	114.1949	114.1949	113.9590	114.6854	115.4683	116.0217	116.6002 (39)
Average = Sum(39)m / 12 =												115.7405 (39)
HLP	Jan 1.1667	Feb 1.1635	Mar 1.1604	Apr 1.1460	May 1.1433	Jun 1.1306	Jul 1.1306	Aug 1.1283	Sep 1.1355	Oct 1.1433	Nov 1.1487	Dec 1.1545 (40)
HLP (average)												1.1459 (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												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy conte	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Energy content (annual)											Total = Sum(45)m =	1565.1930 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.0770	47.6518	44.1524	45.6241	47.6518	48.0770	50.9589	49.3151	50.9589 (61)
Solar input	213.2359	187.9559	197.4164	175.7622	170.1688	149.8752	143.5919	160.0713	161.8391	183.5377	194.0352	208.1155 (62)
	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	213.2359	187.9559	197.4164	175.7622	170.1688	149.8752	143.5919	160.0713	161.8391	183.5377	194.0352	208.1155 (64)
Heat gains from water heating, kWh/month	66.6968	58.6981	61.4369	54.4746	52.6499	46.1909	43.9803	49.2924	49.8452	56.8222	60.4482	64.9943 (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	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9786	21.2976	17.3203	13.1126	9.8018	8.2751	8.9416	11.6226	15.5998	19.8075	23.1183	24.6450	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.9343	260.6109	253.8661	239.5071	221.3816	204.3461	192.9653	190.2888	197.0336	211.3925	229.5181	246.5536	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	(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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	(71)
Water heating gains (Table 5)	89.6463	87.3483	82.5764	75.6592	70.7659	64.1541	59.1133	66.2533	69.2294	76.3739	83.9558	87.3579	(72)
Total internal gains	438.7881	436.4857	420.9917	395.5078	369.1782	344.0042	328.2491	335.3935	349.0917	374.8028	403.8211	425.7854	(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					5.4500	10.6334	0.6300	0.7000			0.7700	17.7109
South					10.7500	46.7521	0.6300	0.7000			0.7700	153.5964
Solar gains	171.3073	285.3978	377.9451	454.5386	501.8363	496.4100	479.2365	443.2943	403.8785	311.6115	203.9128	147.4861
Total gains	610.0954	721.8834	798.9368	850.0464	871.0146	840.4141	807.4856	778.6878	752.9701	686.4143	607.7339	573.2715

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	59.5241	59.6849	59.8435	60.5994	60.7430	61.4204	61.4204	61.5475	61.1577	60.7430	60.4533	60.1533	
alpha	4.9683	4.9790	4.9896	5.0400	5.0495	5.0947	5.0947	5.1032	5.0772	5.0495	5.0302	5.0102	
util living area	0.9979	0.9949	0.9876	0.9666	0.9086	0.7725	0.6001	0.6411	0.8555	0.9737	0.9954	0.9985	(86)
MIT	19.7402	19.9112	20.1550	20.4614	20.7370	20.9239	20.9833	20.9767	20.8628	20.5042	20.0627	19.7118	(87)
Th 2	19.9468	19.9493	19.9518	19.9635	19.9657	19.9759	19.9759	19.9778	19.9719	19.9657	19.9612	19.9566	(88)
util rest of house	0.9972	0.9931	0.9831	0.9534	0.8704	0.6838	0.4716	0.5142	0.7856	0.9607	0.9935	0.9980	(89)
MIT 2	18.2695	18.5206	18.8763	19.3229	19.6980	19.9223	19.9694	19.9678	19.8601	19.3902	18.7510	18.2350	(90)
Living area fraction	18.4588	18.6996	19.0409	19.4694	19.8317	20.0512	20.0999	20.0977	19.9891	19.5336	18.9199	18.4251	(91)
Temperature adjustment												0.0000	(92)
adjusted MIT	18.4588	18.6996	19.0409	19.4694	19.8317	20.0512	20.0999	20.0977	19.9891	19.5336	18.9199	18.4251	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	607.4762	714.7054	781.0599	803.4672	752.8964	580.8343	393.9869	412.7576	592.5401	654.3205	602.0481	571.4383	(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	1668.3696	1621.6645	1469.8451	1223.3223	938.9576	622.5041	399.6753	421.3828	675.3978	1031.5488	1371.3603	1658.6516	(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	789.3047	609.4765	512.4562	302.2957	138.4295	0.0000	0.0000	0.0000	0.0000	280.6579	553.9048	808.8867	(98)
Space heating												3995.4120	(98)
Space heating per m2												39.5585	(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													4277.7430 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	789.3047	609.4765	512.4562	302.2957	138.4295	0.0000	0.0000	0.0000	0.0000	280.6579	553.9048	808.8867	(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)	845.0800	652.5445	548.6683	323.6571	148.2115	0.0000	0.0000	0.0000	0.0000	300.4902	593.0459	866.0457	(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	213.2359	187.9559	197.4164	175.7622	170.1688	149.8752	143.5919	160.0713	161.8391	183.5377	194.0352	208.1155	(64)
Efficiency of water heater (217)m	88.0446	87.7972	87.3448	86.4044	84.5368	80.3000	80.3000	80.3000	80.3000	86.1173	87.5434	88.1316	(216)
Fuel for water heating, kWh/month	242.1909	214.0798	226.0198	203.4182	201.2957	186.6441	178.8193	199.3416	201.5431	213.1253	221.6444	236.1418	(219)
Water heating fuel used												2524.2639	(219)
Annual totals kWh/year													
Space heating fuel - main system												4277.7430	(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)												423.4691	(232)
Total delivered energy for all uses												7300.4760	(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	4277.7430	0.2160	923.9925 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2524.2639	0.2160	545.2410 (264)
Space and water heating			1469.2335 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.4691	0.5190	219.7805 (268)
Total CO2, kg/m2/year			1727.9390 (272)
Emissions per m2 for space and water heating			14.5469 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1760 (272b)
Emissions per m2 for pumps and fans			0.3854 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5469 * 1.00) + 2.1760 + 0.3854, rounded to 2 d.p.			17.1100 (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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1571 (8)
Pressure test					Yes
Measured/design AP50					4.6100
Infiltration rate					0.3876 (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) =	0.3294 (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	0.4200	0.4118	0.4035	0.3624	0.3541	0.3129	0.3129	0.3047	0.3294	0.3541	0.3706	0.3871 (22b)
Effective ac	0.5882	0.5848	0.5814	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5749 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.7127		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) =		25175.3997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.2614 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8312 (36)
Total fabric heat loss					(33) + (36) =		72.5438 (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	49.4381	49.1502	48.8681	47.5427	47.2947	46.1404	46.1404	45.9266	46.5850	47.2947	47.7964	48.3208 (38)
Heat transfer coeff	121.9819	121.6941	121.4119	120.0865	119.8386	118.6842	118.6842	118.4705	119.1289	119.8386	120.3402	120.8646 (39)
Average = Sum(39)m / 12 =												120.0853 (39)
HLP	1.2077	1.2049	1.2021	1.1890	1.1865	1.1751	1.1751	1.1730	1.1795	1.1865	1.1915	1.1967 (40)
HLP (average)												1.1890 (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												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy conte	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Energy content (annual)										Total = Sum(45)m =		1565.1930 (45)

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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	34.4839	30.1598	31.1222	27.1331	26.0349	22.4661	20.8182	23.8891	24.1744	28.1730	30.7530	33.3958 (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	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9786	21.2976	17.3203	13.1126	9.8018	8.2751	8.9416	11.6226	15.5998	19.8075	23.1183	24.6450	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.9343	260.6109	253.8661	239.5071	221.3816	204.3461	192.9653	190.2888	197.0336	211.3925	229.5181	246.5536	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	(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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	(71)
Water heating gains (Table 5)	46.3493	44.8807	41.8309	37.6849	34.9931	31.2029	27.9814	32.1091	33.5756	37.8669	42.7125	44.8868	(72)
Total internal gains	392.4911	391.0180	377.2462	354.5335	330.4054	308.0530	294.1172	298.2493	310.4379	333.2959	359.5778	380.3143	(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					5.4500	10.6334	0.4500	0.0000				0.7700	20.0804 (74)
South					10.7500	46.7521	0.4500	0.0000				0.7700	174.1456 (78)
Solar gains	194.2260	323.5802	428.5092	515.3499	568.9754	562.8231	543.3520	502.6013	457.9121	353.3010	231.1936	167.2178	(83)
Total gains	586.7170	714.5982	805.7554	869.8834	899.3808	870.8761	837.4692	800.8506	768.3500	686.5968	590.7715	547.5321	(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	57.3295	57.4651	57.5987	58.2344	58.3549	58.9225	58.9225	59.0288	58.7025	58.3549	58.1116	57.8595	
alpha	4.8220	4.8310	4.8399	4.8823	4.8903	4.9282	4.9282	4.9353	4.9135	4.8903	4.8741	4.8573	
util living area	0.9982	0.9951	0.9875	0.9655	0.9057	0.7699	0.5992	0.6443	0.8576	0.9749	0.9959	0.9987	(86)
MIT	19.6613	19.8482	20.1093	20.4326	20.7223	20.9173	20.9811	20.9731	20.8489	20.4658	19.9969	19.6288	(87)
Th 2	19.9138	19.9161	19.9183	19.9288	19.9308	19.9400	19.9400	19.9417	19.9364	19.9308	19.9268	19.9227	(88)
util rest of house	0.9976	0.9934	0.9830	0.9519	0.8661	0.6789	0.4670	0.5134	0.7869	0.9623	0.9943	0.9983	(89)
MIT 2	18.6970	18.8849	19.1455	19.4694	19.7388	19.9006	19.9351	19.9339	19.8524	19.5073	19.0423	18.6716	(90)
Living area fraction									fLA = Living area / (4) =			0.1287	(91)
MIT	18.8211	19.0089	19.2695	19.5934	19.8654	20.0314	20.0697	20.0676	19.9806	19.6306	19.1652	18.7948	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8211	19.0089	19.2695	19.5934	19.8654	20.0314	20.0697	20.0676	19.9806	19.6306	19.1652	18.7948	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9915	0.9793	0.9464	0.8632	0.6877	0.4840	0.5301	0.7904	0.9576	0.9926	0.9976	(94)
Ext temp.	584.8094	708.5199	789.0964	823.2608	776.3795	598.9168	405.3711	424.5199	607.2692	657.4820	586.3729	546.2452	(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	1771.3170	1716.9695	1550.3710	1284.1330	978.5286	644.6249	411.7983	434.5070	700.5521	1082.2185	1451.9254	1763.9977	(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	882.7616	677.6781	566.3883	331.8280	150.3989	0.0000	0.0000	0.0000	0.0000	316.0039	623.1978	906.0078	(98)
Space heating per m2												4454.2644	(98)
										(98) / (4) =		44.1016	(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	1115.6317	878.2632	900.3755	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8344	0.9053	0.8860	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	930.8646	795.0634	797.6972	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	1123.9420	1082.6420	1041.8466	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	139.0158	213.9585	181.6472	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												534.6215 (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	34.7539	53.4896	45.4118	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.6554 (107)
Space cooling per m2												1.3233 (108)
Energy for space heating												44.1016 (99)
Energy for space cooling												1.3233 (108)
Total												45.4249 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.4 (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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 254.6950 (5)
Dwelling volume			

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																4 * 10 =	40.0000 (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) =					40.0000 / (5) =	0.1571 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.4071 (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) =					0.3460 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4411	0.4325	0.4238	0.3806	0.3719	0.3287	0.3287	0.3200	0.3460	0.3719	0.3892	0.4065	(22b)				
Effective ac	0.5973	0.5935	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5826	(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			4.0000	1.0000	4.0000		(26)					
TER Opening Type (Uw = 1.40)			16.2000	1.3258	21.4773		(27)					
ground			52.7000	0.1300	6.8510		(28a)					
external	116.9200	20.2000	96.7200	0.1800	17.4096		(29a)					
cd	52.7000		52.7000	0.1300	6.8510		(30)					
Total net area of external elements Aum(A, m2)			222.3200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	56.5889		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0410 (36)					
Total fabric heat loss						(33) + (36) =	67.6299 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.2029	Feb 49.8853	Mar 49.5741	Apr 48.1120	May 47.8384	Jun 46.5650	Jul 46.5650	Aug 46.3292	Sep 47.0555	Oct 47.8384	Nov 48.3918	Dec 48.9704 (38)
Heat transfer coeff	117.8328	117.5152	117.2039	115.7418	115.4683	114.1949	114.1949	113.9590	114.6854	115.4683	116.0217	116.6002 (39)
Average = Sum(39)m / 12 =												115.7405 (39)
HLP	Jan 1.1667	Feb 1.1635	Mar 1.1604	Apr 1.1460	May 1.1433	Jun 1.1306	Jul 1.1306	Aug 1.1283	Sep 1.1355	Oct 1.1433	Nov 1.1487	Dec 1.1545 (40)
HLP (average)												1.1459 (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												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy conte	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Energy content (annual)											Total = Sum(45)m =	1565.1930 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.4839	30.1598	31.1222	27.1331	26.0349	22.4661	20.8182	23.8891	24.1744	28.1730	30.7530	33.3958 (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	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296	137.4296 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9786	21.2976	17.3203	13.1126	9.8018	8.2751	8.9416	11.6226	15.5998	19.8075	23.1183	24.6450 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.9343	260.6109	253.8661	239.5071	221.3816	204.3461	192.9653	190.2888	197.0336	211.3925	229.5181	246.5536 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430	36.7430 (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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)	46.3493	44.8807	41.8309	37.6849	34.9931	31.2029	27.9814	32.1091	33.5756	37.8669	42.7125	44.8868 (72)
Total internal gains	392.4911	391.0180	377.2462	354.5335	330.4054	308.0530	294.1172	298.2493	310.4379	333.2959	359.5778	380.3143 (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					5.4500	10.6334	0.6300	0.7000			0.7700	17.7109 (74)
South					10.7500	46.7521	0.6300	0.7000			0.7700	153.5964 (78)
Solar gains	171.3073	285.3978	377.9451	454.5386	501.8363	496.4100	479.2365	443.2943	403.8785	311.6115	203.9128	147.4861 (83)
Total gains	563.7984	676.4158	755.1913	809.0721	832.2417	804.4630	773.3536	741.5436	714.3164	644.9073	563.4906	527.8004 (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	59.5241	59.6849	59.8435	60.5994	60.7430	61.4204	61.4204	61.5475	61.1577	60.7430	60.4533	60.1533
alpha	4.9683	4.9790	4.9896	5.0400	5.0495	5.0947	5.0947	5.1032	5.0772	5.0495	5.0302	5.0102
util living area	0.9986	0.9962	0.9902	0.9724	0.9210	0.7934	0.6224	0.6668	0.8751	0.9795	0.9967	0.9990 (86)
MIT	19.6977	19.8700	20.1168	20.4289	20.7138	20.9136	20.9803	20.9722	20.8450	20.4701	20.0224	19.6699 (87)
Th 2	19.9468	19.9493	19.9518	19.9635	19.9657	19.9759	19.9759	19.9778	19.9719	19.9657	19.9612	19.9566 (88)
util rest of house	0.9981	0.9948	0.9866	0.9612	0.8862	0.7066	0.4912	0.5378	0.8099	0.9690	0.9953	0.9986 (89)
MIT 2	18.7592	18.9330	19.1800	19.4956	19.7638	19.9335	19.9706	19.9695	19.8835	19.5406	19.0950	18.7393 (90)
Living area fraction									fLA = Living area / (4) =			0.1287 (91)
MIT	18.8800	19.0536	19.3006	19.6157	19.8860	20.0596	20.1006	20.0985	20.0072	19.6603	19.2144	18.8591 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8800	19.0536	19.3006	19.6157	19.8860	20.0596	20.1006	20.0985	20.0072	19.6603	19.2144	18.8591 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9973	0.9932	0.9836	0.9563	0.8830	0.7146	0.5081	0.5542	0.8126	0.9648	0.9939	0.9981 (94)
Useful gains	562.3028	671.8451	742.7805	773.7275	734.8430	574.9084	392.9310	410.9668	580.4249	622.1928	560.0758	526.7875 (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	1718.0034	1663.2683	1500.2817	1240.2534	945.2286	623.4634	399.7477	421.4820	677.4716	1046.1720	1405.5341	1709.2553 (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	859.8412	666.2364	563.5808	335.8986	156.5269	0.0000	0.0000	0.0000	0.0000	315.4405	608.7300	879.7560 (98)
Space heating												4386.0105 (98)
Space heating per m2										(98) / (4) =		43.4258 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1073.4317	845.0420	866.0887	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8250	0.8999	0.8805	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	885.6301	760.4949	762.6251	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1046.3163	1007.7018	972.5268	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	115.6941	183.9219	156.1669	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												455.7828 (104)
Cooled fraction									fC = cooled area / (4) =			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	28.9235	45.9805	39.0417	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											113.9457 (107)
Space cooling per m2											1.1282 (108)
Energy for space heating											43.4258 (99)
Energy for space cooling											1.1282 (108)
Total											44.5540 (109)
Target Fabric Energy Efficiency (TFEE)											51.2 (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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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					4.6100
Infiltration rate					0.2305 (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) =		0.1959 (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	0.2302	0.2155	0.2155	0.1959	0.2008	0.1910	0.1910	0.1861	0.1861	0.2008	0.1959	0.2008 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.7127		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) =	25175.3997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.2614 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8312 (36)
Total fabric heat loss						(33) + (36) =	72.5438 (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	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247 (38)
Heat transfer coeff	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685 (39)
Average = Sum(39)m / 12 =												114.5685 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343 (40)
HLP (average)												1.1343 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy content (annual)	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1565.1930 (45)
Water storage loss:	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (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	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	14.1460	12.7659	14.1081	13.6116	14.0315	13.5400	13.9671	14.0089	13.5790	14.0747	13.6601	14.1337 (61)
Total heat required for water heating calculated for each month	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (64)
RHI water heating demand												1731 (64)
Heat gains from water heating, kWh/month	57.4936	50.3827	52.2241	45.8582	44.2448	38.5378	36.0661	40.8817	41.2206	47.6011	51.5345	55.7880 (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	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9464	53.2439	43.3008	32.7815	24.5046	20.6878	22.3539	29.0564	38.9995	49.5188	57.7958	61.6125 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.9766	388.9715	378.9046	357.4733	330.4203	304.9942	288.0080	284.0131	294.0800	315.5113	342.5643	367.9904 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401 (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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)	77.2764	74.9743	70.1937	63.6920	59.4688	53.5248	48.4759	54.9485	57.2509	63.9800	71.5756	74.9839 (72)
Total internal gains	634.4114	629.4016	604.6112	566.1588	526.6056	491.4187	471.0497	480.2300	502.5424	541.2221	584.1477	616.7989 (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					5.4500	13.4684	0.4500		0.0000			0.7700			25.4341 (74)
South					10.7500	56.5862	0.4500		0.0000			0.7700			210.7766 (78)

Solar gains	236.2107	334.6205	452.0208	550.0294	576.4898	633.6339	586.6680	561.9970	506.8976	394.3068	280.1341	192.6096 (83)			
Total gains	870.6221	964.0221	1056.6320	1116.1883	1103.0954	1125.0527	1057.7177	1042.2270	1009.4400	935.5289	864.2819	809.4085 (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	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392
alpha	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693
util living area	0.9857	0.9758	0.9477	0.8783	0.7432	0.5102	0.3562	0.3506	0.6107	0.8690	0.9668	0.9892 (86)
MIT	20.1530	20.2730	20.5010	20.7491	20.9203	20.9903	20.9988	20.9989	20.9765	20.8068	20.4532	20.1099 (87)
Th 2	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729 (88)
util rest of house	0.9810	0.9681	0.9310	0.8407	0.6713	0.4119	0.2460	0.2387	0.5099	0.8196	0.9542	0.9855 (89)
MIT 2	19.2320	19.3489	19.5674	19.7928	19.9291	19.9699	19.9727	19.9728	19.9642	19.8465	19.5258	19.1900 (90)
Living area fraction	19.3506	19.4678	19.6876	19.9159	20.0567	20.1013	20.1048	20.1048	fLA = Living area / (4) =	19.9701	19.6452	0.1287 (91)
MIT	19.3506	19.4678	19.6876	19.9159	20.0567	20.1013	20.1048	20.1048	20.0945	19.9701	19.6452	19.3084 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2006	19.3178	19.5376	19.7659	19.9067	19.9513	19.9548	19.9548	19.9445	19.8201	19.4952	19.1584 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9762	0.9617	0.9223	0.8319	0.6663	0.4098	0.2441	0.2368	0.5069	0.8109	0.9465	0.9815 (94)
Ext temp.	849.9238	927.1328	974.5092	928.5774	734.9675	461.0683	258.1750	246.7492	511.7093	758.6622	818.0742	794.4514 (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	1558.1948	1525.8057	1367.6674	1107.4031	779.8304	464.1473	258.3289	246.8764	520.6614	884.4813	1248.2451	1541.9117 (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	526.9536	402.3082	292.5097	128.7545	33.3780	0.0000	0.0000	0.0000	0.0000	93.6094	309.7230	556.1104 (98)
RHI space heating demand												2343.3469 (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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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																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														4.6100			
Infiltration rate														0.2305 (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) =				0.1959 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2498	0.2449	0.2400	0.2155	0.2106	0.1861	0.1861	0.1812	0.1959	0.2106	0.2204	0.2302 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.7127		(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) =	25175.3997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.2614 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8312 (36)
Total fabric heat loss						(33) + (36) =	72.5438 (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	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247 (38)
Heat transfer coeff	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685 (39)
Average = Sum(39)m / 12 =												114.5685 (39)
HLP	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343 (40)
HLP (average)												1.1343 (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	2.7486 (42)
Average daily hot water use (litres/day)	99.4791 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy content (annual)	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1565.1930 (45)
	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (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	14.1460	12.7659	14.1081	13.6116	14.0315	13.5400	13.9671	14.0089	13.5790	14.0747	13.6601	14.1337 (61)
Total heat required for water heating calculated for each month	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (64)
Heat gains from water heating, kWh/month	57.4936	50.3827	52.2241	45.8582	44.2448	38.5378	36.0661	40.8817	41.2206	47.6011	51.5345	55.7880 (65)
								Total per year (kWh/year) = Sum(64)m =				1730.8196 (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
	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9464	53.2439	43.3008	32.7815	24.5046	20.6878	22.3539	29.0564	38.9995	49.5188	57.7958	61.6125 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.9766	388.9715	378.9046	357.4733	330.4203	304.9942	288.0080	284.0131	294.0800	315.5113	342.5643	367.9904 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401 (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)												
	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)												
	77.2764	74.9743	70.1937	63.6920	59.4688	53.5248	48.4759	54.9485	57.2509	63.9800	71.5756	74.9839 (72)
Total internal gains	634.4114	629.4016	604.6112	566.1588	526.6056	491.4187	471.0497	480.2300	502.5424	541.2221	584.1477	616.7989 (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					5.4500	10.6334	0.4500		0.0000				0.7700	20.0804 (74)
South					10.7500	46.7521	0.4500		0.0000				0.7700	174.1456 (78)

Solar gains	194.2260	323.5802	428.5092	515.3499	568.9754	562.8231	543.3520	502.6013	457.9121	353.3010	231.1936	167.2178 (83)		
Total gains	828.6374	952.9818	1033.1203	1081.5087	1095.5810	1054.2418	1014.4017	982.8313	960.4545	894.5230	815.3414	784.0167 (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	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392
alpha	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693
util living area	0.9918	0.9827	0.9639	0.9198	0.8234	0.6577	0.4896	0.5254	0.7448	0.9293	0.9833	0.9937 (86)
MIT	19.9798	20.1512	20.3781	20.6340	20.8473	20.9628	20.9931	20.9901	20.9297	20.6633	20.2609	19.9291 (87)
Th 2	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729 (88)
util rest of house	0.9892	0.9774	0.9527	0.8941	0.7694	0.5674	0.3792	0.4136	0.6615	0.9013	0.9772	0.9917 (89)
MIT 2	19.0607	19.2294	19.4501	19.6910	19.8749	19.9566	19.9712	19.9702	19.9378	19.7228	19.3391	19.0106 (90)
Living area fraction									fLA = Living area / (4) =			0.1287 (91)
MIT	19.1790	19.3480	19.5695	19.8123	20.0000	20.0861	20.1027	20.1015	20.0655	19.8438	19.4577	19.1288 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0290	19.1980	19.4195	19.6623	19.8500	19.9361	19.9527	19.9515	19.9155	19.6938	19.3077	18.9788 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9860	0.9721	0.9450	0.8848	0.7621	0.5639	0.3769	0.4112	0.6564	0.8918	0.9719	0.9891 (94)
Useful gains	817.0200	926.4079	976.2950	956.9205	834.9514	594.5161	382.3752	404.1497	630.4131	797.7746	792.4213	775.4407 (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	1687.4783	1638.1025	1480.1678	1233.0261	933.7377	611.3508	384.1171	406.8907	666.2741	1041.8646	1398.6220	1693.1847 (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	647.6209	478.2588	374.8814	198.7960	73.4970	0.0000	0.0000	0.0000	0.0000	181.6029	436.4645	682.8015 (98)
Space heating												3073.9231 (98)
Space heating per m ²										(98) / (4) =		30.4349 (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												3396.6001	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	647.6209	478.2588	374.8814	198.7960	73.4970	0.0000	0.0000	0.0000	0.0000	181.6029	436.4645	682.8015	(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)	715.6032	528.4628	414.2336	219.6641	81.2122	0.0000	0.0000	0.0000	0.0000	200.6662	482.2812	754.4768	(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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904	(64)
Efficiency of water heater	89.7953	89.6964	89.5161	89.1425	88.3937	87.3000	87.3000	87.3000	87.3000	89.0418	89.6253	87.3000	(216)
(217)m	89.7953	89.6964	89.5161	89.1425	88.3937	87.3000	87.3000	87.3000	87.3000	89.0418	89.6253	89.8396	(217)
Fuel for water heating, kWh/month	196.4725	172.4644	179.3707	158.5067	154.4778	136.6126	128.2186	144.8205	145.8661	164.7018	176.7138	190.6625	(219)
Water heating fuel used												1948.8880	(219)
Annual totals kWh/year													
Space heating fuel - main system												3396.6001	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)												67.2516	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												142.2516	(231)
Electricity for lighting (calculated in Appendix L)												423.4691	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1068 * 1.00) =										-512.6739		-512.6739	(233)
Total delivered energy for all uses												5398.5350	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3396.6001	3.4800	118.2017 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1948.8880	3.4800	67.8213 (247)
Mechanical ventilation fans	67.2516	13.1900	8.8705 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	423.4691	13.1900	55.8556 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-512.6739	13.1900	-67.6217 (252)
Total energy cost			313.0199 (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] = 0.9005 (257)
SAP value	87.4385
SAP rating (Section 12)	87 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3396.6001	0.2160	733.6656 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1948.8880	0.2160	420.9598 (264)
Space and water heating			1154.6254 (265)
Pumps and fans	142.2516	0.5190	73.8286 (267)
Energy for lighting	423.4691	0.5190	219.7805 (268)
Energy saving/generation technologies			
PV Unit	-512.6739	0.5190	-266.0777 (269)
Total kg/year			1182.1568 (272)
CO2 emissions per m2			11.7000 (273)
EI value			89.1501
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	$3.48 / 0.8869 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8869 = 0.2436$, 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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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					4.6100
Infiltration rate					0.2305 (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)	=	0.1959 (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	0.2302	0.2155	0.2155	0.1959	0.2008	0.1910	0.1910	0.1861	0.1861	0.2008	0.1959	0.2008 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	63.7127			(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) =	25175.3997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.2614 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8312 (36)
Total fabric heat loss						(33) + (36) =	72.5438 (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	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247 (38)
Heat transfer coeff	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685 (39)
Average = Sum(39)m / 12 =												114.5685 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343 (40)
HLP (average)												1.1343 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy content (annual)	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1565.1930 (45)
	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (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	14.1460	12.7659	14.1081	13.6116	14.0315	13.5400	13.9671	14.0089	13.5790	14.0747	13.6601	14.1337 (61)
Total heat required for water heating calculated for each month	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (64)
Heat gains from water heating, kWh/month	57.4936	50.3827	52.2241	45.8582	44.2448	38.5378	36.0661	40.8817	41.2206	47.6011	51.5345	55.7880 (65)
								Total per year (kWh/year) =	Sum(64)m =			1730.8196 (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
	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9464	53.2439	43.3008	32.7815	24.5046	20.6878	22.3539	29.0564	38.9995	49.5188	57.7958	61.6125 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.9766	388.9715	378.9046	357.4733	330.4203	304.9942	288.0080	284.0131	294.0800	315.5113	342.5643	367.9904 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401 (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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)	77.2764	74.9743	70.1937	63.6920	59.4688	53.5248	48.4759	54.9485	57.2509	63.9800	71.5756	74.9839 (72)
Total internal gains	634.4114	629.4016	604.6112	566.1588	526.6056	491.4187	471.0497	480.2300	502.5424	541.2221	584.1477	616.7989 (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					5.4500	13.4684	0.4500		0.0000			0.7700			25.4341 (74)
South					10.7500	56.5862	0.4500		0.0000			0.7700			210.7766 (78)
Solar gains	236.2107	334.6205	452.0208	550.0294	576.4898	633.6339	586.6680	561.9970	506.8976	394.3068	280.1341	192.6096 (83)			
Total gains	870.6221	964.0221	1056.6320	1116.1883	1103.0954	1125.0527	1057.7177	1042.2270	1009.4400	935.5289	864.2819	809.4085 (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	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392
alpha	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693
util living area	0.9857	0.9758	0.9477	0.8783	0.7432	0.5102	0.3562	0.3506	0.6107	0.8690	0.9668	0.9892 (86)
MIT	20.1530	20.2730	20.5010	20.7491	20.9203	20.9903	20.9988	20.9989	20.9765	20.8068	20.4532	20.1099 (87)
Th 2	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729 (88)
util rest of house	0.9810	0.9681	0.9310	0.8407	0.6713	0.4119	0.2460	0.2387	0.5099	0.8196	0.9542	0.9855 (89)
MIT 2	19.2320	19.3489	19.5674	19.7928	19.9291	19.9699	19.9727	19.9728	19.9642	19.8465	19.5258	19.1900 (90)
Living area fraction									fLA = Living area / (4) =			0.1287 (91)
MIT	19.3506	19.4678	19.6876	19.9159	20.0567	20.1013	20.1048	20.1048	20.0945	19.9701	19.6452	19.3084 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2006	19.3178	19.5376	19.7659	19.9067	19.9513	19.9548	19.9548	19.9445	19.8201	19.4952	19.1584 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9762	0.9617	0.9223	0.8319	0.6663	0.4098	0.2441	0.2368	0.5069	0.8109	0.9465	0.9815 (94)
Useful gains	849.9238	927.1328	974.5092	928.5774	734.9675	461.0683	258.1750	246.7492	511.7093	758.6622	818.0742	794.4514 (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	1558.1948	1525.8057	1367.6674	1107.4031	779.8304	464.1473	258.3289	246.8764	520.6614	884.4813	1248.2451	1541.9117 (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	526.9536	402.3082	292.5097	128.7545	33.3780	0.0000	0.0000	0.0000	0.0000	93.6094	309.7230	556.1104 (98)
Space heating												2343.3469 (98)
Space heating per m2										(98) / (4) =		23.2015 (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													2589.3335 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.9536	402.3082	292.5097	128.7545	33.3780	0.0000	0.0000	0.0000	0.0000	93.6094	309.7230	556.1104	(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)	582.2692	444.5394	323.2151	142.2702	36.8817	0.0000	0.0000	0.0000	0.0000	103.4358	342.2354	614.4867	(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	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904	(64)
Efficiency of water heater (217)m	89.6755	89.5880	89.3395	88.7970	87.9106	87.3000	87.3000	87.3000	87.3000	88.5195	89.3914	87.3000	(216)
Fuel for water heating, kWh/month	196.7349	172.6732	179.7253	159.1234	155.3266	136.6126	128.2186	144.8205	145.8661	165.6737	177.1762	190.9049	(219)
Water heating fuel used												1952.8561	(219)
Annual totals kWh/year													
Space heating fuel - main system												2589.3335	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)												67.2516	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												142.2516	(231)
Electricity for lighting (calculated in Appendix L)												423.4691	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1184 * 1.00) =											-568.2802	-568.2802	(233)
Total delivered energy for all uses												4539.6302	(238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2589.3335	9.7400	252.2011 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1952.8561	9.7400	190.2082 (247)
Mechanical ventilation fans	67.2516	36.8500	24.7822 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	423.4691	36.8500	156.0484 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-568.2802	36.8500	-209.4112 (252)
Total energy cost			545.4661 (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	2589.3335	0.2160	559.2960 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1952.8561	0.2160	421.8169 (264)
Space and water heating			981.1130 (265)
Pumps and fans	142.2516	0.5190	73.8286 (267)
Energy for lighting	423.4691	0.5190	219.7805 (268)
Energy saving/generation technologies			
PV Unit	-568.2802	0.5190	-294.9374 (269)
Total kg/year			979.7846 (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	2589.3335	1.2200	3158.9869 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1952.8561	1.2200	2382.4844 (264)
Space and water heating			5541.4713 (265)
Pumps and fans	142.2516	3.0700	436.7124 (267)
Energy for lighting	423.4691	3.0700	1300.0502 (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	-568.2802	3.0700	-1744.6201 (269)
Primary energy kWh/year			5533.6139 (272)
Primary energy kWh/m2/year			54.7883 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

(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	-£ 81	-194 kg (19.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 1.92 kg/m²	B 89	B 91
Total Savings	£81 1.92 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 519 TEST (31 May 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	£208	£227	-£19
Mains gas	£546	£447	£99
Space heating	£409	£409	£0
Water heating	£190	£109	£81
Lighting	£156	£156	£0
Generated (PV)	-£209	-£209	£0
Total cost of fuels	£545	£465	£81
Total cost of uses	£546	£465	£81
Delivered energy	45 kWh/m²	35 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	44 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	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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					4.6100
Infiltration rate					0.2305 (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)	=	0.1959 (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	0.2498	0.2449	0.2400	0.2155	0.2106	0.1861	0.1861	0.1812	0.1959	0.2106	0.2204	0.2302 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	63.7127			(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) = 25175.3997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.2614 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8312 (36)
Total fabric heat loss						(33) + (36) =	72.5438 (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	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247 (38)
Average = Sum(39)m / 12 =	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343 (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												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (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	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy content (annual)	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1565.1930 (45)
	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (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	14.1460	12.7659	14.1081	13.6116	14.0315	13.5400	13.9671	14.0089	13.5790	14.0747	13.6601	14.1337 (61)
Total heat required for water heating calculated for each month	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (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												1.1587 (H8)
Utilisation factor												0.5781 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4791 (H14)
Volume ratio Veff/V												0.7539 (H15)
Solar storage volume factor												0.9435 (H16)
Solar input	-25.2236	-42.0909	-71.6855	-96.0728	-118.6898	-116.6910	-115.1489	-100.6061	-78.7948	-53.8076	-29.9188	-869.8374 (H17)
Solar input (sum of months) = Sum (63)m =												-21.1078 (63)
Output from w/h	151.1995	112.6036	88.8800	45.2240	17.8587	2.5719	0.0000	25.8222	48.5463	92.8460	128.4615	150.1826 (64)
Total per year (kWh/year) = Sum (64)m =												864.1962 (64)
Heat gains from water heating, kWh/month	57.4936	50.3827	52.2241	45.8582	44.2448	38.5378	36.0661	40.8817	41.2206	47.6011	51.5345	55.7880 (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	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9464	53.2439	43.3008	32.7815	24.5046	20.6878	22.3539	29.0564	38.9995	49.5188	57.7958	61.6125 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.9766	388.9715	378.9046	357.4733	330.4203	304.9942	288.0080	284.0131	294.0800	315.5113	342.5643	367.9904 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401 (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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)	77.2764	74.9743	70.1937	63.6920	59.4688	53.5248	48.4759	54.9485	57.2509	63.9800	71.5756	74.9839 (72)
Total internal gains	634.4114	629.4016	604.6112	566.1588	526.6056	491.4187	471.0497	480.2300	502.5424	541.2221	584.1477	616.7989 (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					5.4500	10.6334	0.4500	0.0000			0.7700			20.0804 (74)
South					10.7500	46.7521	0.4500	0.0000			0.7700			174.1456 (78)

Solar gains	194.2260	323.5802	428.5092	515.3499	568.9754	562.8231	543.3520	502.6013	457.9121	353.3010	231.1936	167.2178 (83)		
Total gains	828.6374	952.9818	1033.1203	1081.5087	1095.5810	1054.2418	1014.4017	982.8313	960.4545	894.5230	815.3414	784.0167 (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	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392
alpha	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693
util living area	0.9918	0.9827	0.9639	0.9198	0.8234	0.6577	0.4896	0.5254	0.7448	0.9293	0.9833	0.9937 (86)
MIT	19.9798	20.1512	20.3781	20.6340	20.8473	20.9628	20.9931	20.9901	20.9297	20.6633	20.2609	19.9291 (87)
Th 2	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729 (88)
util rest of house	0.9892	0.9774	0.9527	0.8941	0.7694	0.5674	0.3792	0.4136	0.6615	0.9013	0.9772	0.9917 (89)
MIT 2	19.0607	19.2294	19.4501	19.6910	19.8749	19.9566	19.9712	19.9702	19.9378	19.7228	19.3391	19.0106 (90)
Living area fraction									fLA = Living area / (4) =			0.1287 (91)
MIT	19.1790	19.3480	19.5695	19.8123	20.0000	20.0861	20.1027	20.1015	20.0655	19.8438	19.4577	19.1288 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0290	19.1980	19.4195	19.6623	19.8500	19.9361	19.9527	19.9515	19.9155	19.6938	19.3077	18.9788 (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	0.9860	0.9721	0.9450	0.8848	0.7621	0.5639	0.3769	0.4112	0.6564	0.8918	0.9719	0.9891	(94)
Useful gains	817.0200	926.4079	976.2950	956.9205	834.9514	594.5161	382.3752	404.1497	630.4131	797.7746	792.4213	775.4407	(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	1687.4783	1638.1025	1480.1678	1233.0261	933.7377	611.3508	384.1171	406.8907	666.2741	1041.8646	1398.6220	1693.1847	(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	647.6209	478.2588	374.8814	198.7960	73.4970	0.0000	0.0000	0.0000	0.0000	181.6029	436.4645	682.8015	(98)
Space heating												3073.9231	(98)
Space heating per m2											(98) / (4) =	30.4349	(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													3396.6001	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	647.6209	478.2588	374.8814	198.7960	73.4970	0.0000	0.0000	0.0000	0.0000	181.6029	436.4645	682.8015	(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)	715.6032	528.4628	414.2336	219.6641	81.2122	0.0000	0.0000	0.0000	0.0000	200.6662	482.2812	754.4768	(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	151.1995	112.6036	88.8800	45.2240	17.8587	2.5719	0.0000	25.8222	48.5463	92.8460	128.4615	150.1826	(64)	
Efficiency of water heater	89.8764	89.8722	89.8687	89.8894	89.8561	87.3000	87.3000	87.3000	87.3000	89.3915	89.7519	87.3000	(216)	
(217)m	89.8764	89.8722	89.8687	89.8894	89.8561	87.3000	87.3000	87.3000	87.3000	89.3915	89.7519	89.9058	(217)	
Fuel for water heating, kWh/month	168.2304	125.2930	98.8999	50.3108	19.8748	2.9460	0.0000	29.5787	55.6086	103.8644	143.1295	167.0443	(219)	
Water heating fuel used												964.7804	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3396.6001	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)														
mechanical ventilation fans (SFP = 0.2164)													67.2516	(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													192.2516	(231)
Electricity for lighting (calculated in Appendix L)													423.4691	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.60 * 1068 * 1.00) =										-512.6739		-512.6739	(233)	
Total delivered energy for all uses												4464.4274	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3396.6001	3.4800	118.2017	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	964.7804	3.4800	33.5744	(247)
Mechanical ventilation fans	67.2516	13.1900	8.8705	(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	423.4691	13.1900	55.8556	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-512.6739	13.1900	-67.6217	(252)
Total energy cost			285.3679	(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] =	0.8209	(257)
SAP value		88.5481	
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	3396.6001	0.2160	733.6656 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	964.7804	0.2160	208.3926 (264)
Space and water heating			942.0582 (265)
Pumps and fans	192.2516	0.5190	99.7786 (267)
Energy for lighting	423.4691	0.5190	219.7805 (268)
Energy saving/generation technologies			
PV Unit	-512.6739	0.5190	-266.0777 (269)
Total kg/year			995.5395 (272)
CO2 emissions per m2			9.8600 (273)
EI value			90.8629
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	52.7000 (1b)	x 2.4500 (2b)	= 129.1150 (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)	101.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.6950 (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					4.6100
Infiltration rate					0.2305 (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) =		0.1959 (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	0.2302	0.2155	0.2155	0.1959	0.2008	0.1910	0.1910	0.1861	0.1861	0.2008	0.1959	0.2008 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.2000	1.3258	21.4773		(27)
ground			52.7000	0.1200	6.3240	75.0000	3952.5001 (28a)
external	116.9200	20.2000	96.7200	0.2700	26.1144	150.0000	14507.9998 (29a)
cd	52.7000		52.7000	0.1100	5.7970	9.0000	474.3000 (30)
Total net area of external elements Aum(A, m ²)			222.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	63.7127			(33)
party			31.8200	0.0000	0.0000	45.0000	1431.9000 (32)
stud			161.9000			9.0000	1457.0999 (32c)
block			27.3000			75.0000	2047.4999 (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) =	25175.3997			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				249.2614			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.8312			(36)
Total fabric heat loss			(33) + (36) =	72.5438			(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	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247	42.0247 (38)
Heat transfer coeff	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685	114.5685 (39)
Average = Sum(39)m / 12 =												114.5685 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343	1.1343 (40)
HLP (average)												1.1343 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.7486 (42)
Average daily hot water use (litres/day)												99.4791 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

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	109.4270	105.4478	101.4686	97.4895	93.5103	89.5312	89.5312	93.5103	97.4895	101.4686	105.4478	109.4270 (44)
Energy content (annual)	162.2770	141.9285	146.4575	127.6852	122.5170	105.7229	97.9678	112.4195	113.7621	132.5788	144.7201	157.1566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1565.1930 (45)
	24.3416	21.2893	21.9686	19.1528	18.3776	15.8584	14.6952	16.8629	17.0643	19.8868	21.7080	23.5735 (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	14.1460	12.7659	14.1081	13.6116	14.0315	13.5400	13.9671	14.0089	13.5790	14.0747	13.6601	14.1337 (61)
Total heat required for water heating calculated for each month	176.4231	154.6944	160.5656	141.2968	136.5485	119.2628	111.9348	126.4283	127.3411	146.6535	158.3802	171.2904 (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												1.2945 (H8)
Utilisation factor												0.5382 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4791 (H14)
Volume ratio Veff/V												0.7539 (H15)
Solar storage volume factor												0.9435 (H16)
Solar input												-904.5729 (H17)
Solar input	-29.5174	-41.9770	-72.8409	-97.9833	-113.8632	-123.8502	-117.4289	-107.0837	-83.8142	-57.9294	-34.9123	-23.3723 (63)
								Solar input (sum of months) = Sum (63)m =				-904.5729 (63)
Output from w/h	146.9057	112.7174	87.7247	43.3134	22.6853	0.0000	0.0000	19.3446	43.5269	88.7241	123.4679	147.9181 (64)
								Total per year (kWh/year) = Sum (64)m =				836.3281 (64)
Heat gains from water heating, kWh/month	57.4936	50.3827	52.2241	45.8582	44.2448	38.5378	36.0661	40.8817	41.2206	47.6011	51.5345	55.7880 (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	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155	164.9155 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9464	53.2439	43.3008	32.7815	24.5046	20.6878	22.3539	29.0564	38.9995	49.5188	57.7958	61.6125 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.9766	388.9715	378.9046	357.4733	330.4203	304.9942	288.0080	284.0131	294.0800	315.5113	342.5643	367.9904 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401	54.2401 (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)	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437	-109.9437 (71)
Water heating gains (Table 5)	77.2764	74.9743	70.1937	63.6920	59.4688	53.5248	48.4759	54.9485	57.2509	63.9800	71.5756	74.9839 (72)
Total internal gains	634.4114	629.4016	604.6112	566.1588	526.6056	491.4187	471.0497	480.2300	502.5424	541.2221	584.1477	616.7989 (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					5.4500	13.4684	0.4500			0.0000			0.7700	25.4341 (74)
South					10.7500	56.5862	0.4500			0.0000			0.7700	210.7766 (78)

Solar gains	236.2107	334.6205	452.0208	550.0294	576.4898	633.6339	586.6680	561.9970	506.8976	394.3068	280.1341	192.6096 (83)		
Total gains	870.6221	964.0221	1056.6320	1116.1883	1103.0954	1125.0527	1057.7177	1042.2270	1009.4400	935.5289	864.2819	809.4085 (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	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392	61.0392
alpha	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693	5.0693
util living area	0.9857	0.9758	0.9477	0.8783	0.7432	0.5102	0.3562	0.3506	0.6107	0.8690	0.9668	0.9892 (86)
MIT	20.1530	20.2730	20.5010	20.7491	20.9203	20.9903	20.9988	20.9989	20.9765	20.8068	20.4532	20.1099 (87)
Th 2	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729	19.9729 (88)
util rest of house	0.9810	0.9681	0.9310	0.8407	0.6713	0.4119	0.2460	0.2387	0.5099	0.8196	0.9542	0.9855 (89)
MIT 2	19.2320	19.3489	19.5674	19.7928	19.9291	19.9699	19.9727	19.9728	19.9642	19.8465	19.5258	19.1900 (90)
Living area fraction									fLA = Living area / (4) =			0.1287 (91)
MIT	19.3506	19.4678	19.6876	19.9159	20.0567	20.1013	20.1048	20.1048	20.0945	19.9701	19.6452	19.3084 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2006	19.3178	19.5376	19.7659	19.9067	19.9513	19.9548	19.9548	19.9445	19.8201	19.4952	19.1584 (93)

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Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9762	0.9617	0.9223	0.8319	0.6663	0.4098	0.2441	0.2368	0.5069	0.8109	0.9465	0.9815	(94)
Useful gains	849.9238	927.1328	974.5092	928.5774	734.9675	461.0683	258.1750	246.7492	511.7093	758.6622	818.0742	794.4514	(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	1558.1948	1525.8057	1367.6674	1107.4031	779.8304	464.1473	258.3289	246.8764	520.6614	884.4813	1248.2451	1541.9117	(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	526.9536	402.3082	292.5097	128.7545	33.3780	0.0000	0.0000	0.0000	0.0000	93.6094	309.7230	556.1104	(98)
Space heating												2343.3469	(98)
Space heating per m2											(98) / (4) =	23.2015	(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													2589.3335 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.9536	402.3082	292.5097	128.7545	33.3780	0.0000	0.0000	0.0000	0.0000	93.6094	309.7230	556.1104	(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)	582.2692	444.5394	323.2151	142.2702	36.8817	0.0000	0.0000	0.0000	0.0000	103.4358	342.2354	614.4867	(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	146.9057	112.7174	87.7247	43.3134	22.6853	0.0000	0.0000	19.3446	43.5269	88.7241	123.4679	147.9181	(64)
Efficiency of water heater	89.7825	89.7798	89.7411	89.6726	89.1773	87.3000	87.3000	87.3000	87.3000	88.9141	89.5643	87.3000	(216)
(217)m	89.7825	89.7798	89.7411	89.6726	89.1773	87.3000	87.3000	87.3000	87.3000	88.9141	89.5643	89.8084	(217)
Fuel for water heating, kWh/month	163.6239	125.5488	97.7531	48.3018	25.4384	0.0000	0.0000	22.1587	49.8590	99.7864	137.8539	164.7041	(219)
Water heating fuel used												935.0281	(219)
Annual totals kWh/year													
Space heating fuel - main system												2589.3335	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)													67.2516 (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													192.2516 (231)
Electricity for lighting (calculated in Appendix L)													423.4691 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.60 * 1184 * 1.00) =										-568.2802		-568.2802	(233)
Total delivered energy for all uses												3571.8022	(238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2589.3335	9.7400	252.2011	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	935.0281	9.7400	91.0717	(247)
Mechanical ventilation fans	67.2516	36.8500	24.7822	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	423.4691	36.8500	156.0484	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-568.2802	36.8500	-209.4112	(252)
Total energy cost			464.7547	(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	2589.3335	0.2160	559.2960	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	935.0281	0.2160	201.9661	(264)
Space and water heating			761.2621	(265)
Pumps and fans	192.2516	0.5190	99.7786	(267)

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Energy for lighting	423.4691	0.5190	219.7805 (268)
Energy saving/generation technologies			
PV Unit	-568.2802	0.5190	-294.9374 (269)
Total kg/year			785.8838 (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	2589.3335	1.2200	3158.9869 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	935.0281	1.2200	1140.7343 (264)
Space and water heating			4299.7212 (265)
Pumps and fans	192.2516	3.0700	590.2124 (267)
Energy for lighting	423.4691	3.0700	1300.0502 (268)
Energy saving/generation technologies			
PV Unit	-568.2802	3.0700	-1744.6201 (269)
Primary energy kWh/year			4445.3638 (272)
Primary energy kWh/m2/year			44.0135 (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	North
Overshading	Average or unknown
Thermal mass parameter	249.3 (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	336.20 (P1)
Transmission heat loss coefficient	72.54 (37)
Summer heat loss coefficient	408.74 (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	5.4500	87.1704	0.4500	0.0000	0.9000	192.4069
South	10.7500	118.5567	0.4500	0.0000	0.9000	516.1661
total:						708.5730

	Jun	Jul	Aug	
Solar gains	753	709	664	(P4)
Internal gains	488	468	477	
Total summer gains	1242	1177	1141	(P5)

Summer gain/loss ratio	3.04	2.88	2.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 249.3)	0.26	0.26	0.26	
Threshold temperature	18.69	20.43	20.35	(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 93	Issued on Date	14/06/2023
Assessment Reference	plot 93 ham	Prop Type Ref	21809
Property	21 Hickory Way, Southampton, SO30 0AW		
SAP Rating	87 B	DER	13.56
Environmental	89 B	TER	17.11
CO ₂ Emissions (t/year)	0.98	% DER<TER	20.74
General Requirements Compliance	Pass	DFEE	45.42
		TFEE	51.24
		% DFEE<TFEE	11.34
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jpsustainability.co.uk		Assessor ID
			AU36-0001
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)	17.11	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.56	kgCO ₂ /m ²	Pass
	-3.55 (-20.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.24	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.42	kWh/m ² /yr	
	-5.8 (-11.3%)	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	1.32 (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	4.61 (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

5.45 m², No overhang

Windows facing South

10.75 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

4.61 (measured in this dwelling)

Maximum

10.0

Pass

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

Photovoltaic array

0.60

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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 93	Issued on Date	14/06/2023
Assessment Reference	plot 93 ham	Prop Type Ref	21809
Property	21 Hickory Way, Southampton, SO30 0AW		
SAP Rating	87 B	DER	13.56
Environmental	89 B	TER	17.11
CO ₂ Emissions (t/year)	0.98	% DER<TER	20.74
General Requirements Compliance	Pass	DFEE	45.42
		TFEE	51.24
		% DFEE<TFEE	11.34
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk		Assessor ID
			AU36-0001
Client			

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

Orientation	North					
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						
		Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
		1st Storey:	1.00 m	52.70 m ²	2.45 m	
			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	249.26			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)
external	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure		0.27	150.00	116.92
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	161.90
block	Dense block, plasterboard on dabs				75.00	27.30
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)
cd	External Plane Roof	Plasterboard, insulated at ceiling level		0.11	9.00	52.70

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	52.70

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	Manufacturer	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	East							2.00	
garage entrance	Solid Door	[1] external	South							2.00	
front	Window	[1] external	North	None	0.00					5.45	
rear	Window	[1] external	South	None	0.00					10.75	

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)	13.90	0.300	No
Independently assessed	E3 Sill	10.50	0.015	No
Independently assessed	E4 Jamb	28.80	0.011	No
Independently assessed	E5 Ground floor (normal)	24.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	21.60	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.10	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.10	0.063	No
Independently assessed	E16 Corner (normal)	12.55	0.067	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	2.45	-0.090	No
Independently assessed	E18 Party wall between dwellings	10.20	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	0.040	W/m²K
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18.0 Pressure Testing

Yes

Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
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Property Tested ?	Yes	
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As Built AP ₅₀	4.61	m³/(h.m²) @ 50 Pa
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19.0 Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Summer Overheating

Windows open in hot weather	Windows half open
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	3

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	21	
Total number of L.E.L. fittings	21	
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	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Sap Code	2106
Flue Type	Balanced
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			
	Orientation	Elevation	Overshading	Connected to Dwelling
	PV Cells kWp			
0.60	South	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	£81	B 89	