

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 22			Issued on Date	15/05/2023
Assessment Reference	plot 22 hamblewood	Prop Type Ref	21809		
Property	41 Alder Avenue, Hedge End, Southampton, SO30 0AS				
SAP Rating	87 B	DER	14.13	TER	17.92
Environmental	89 B	% DER<TER	21.13		
CO ₂ Emissions (t/year)	0.91	DFEE	45.64	TFEE	50.98
General Requirements Compliance	Pass	% DFEE<TFEE	10.49		
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk			Assessor ID	AU40-0001
Client					

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Semi-Detached House, total floor area 92 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) 17.92 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.6 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	1.34 (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: 4.68 (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: 4.40 m², No overhang

Windows facing South: 4.75 m², No overhang

Windows facing West: 0.65 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 0.90 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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.6800
Infiltration rate					0.2340 (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) =		0.1989 (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	0.2536	0.2486	0.2437	0.2188	0.2138	0.1890	0.1890	0.1840	0.1989	0.2138	0.2238	0.2337 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5036	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20981.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.5556 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5245 (36)
Total fabric heat loss						(33) + (36) =	58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5214	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462 (38)
Heat transfer coeff	97.0345	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593 (39)
Average = Sum(39)m / 12 =												96.7822 (39)
HLP	1.0570	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540 (40)
HLP (average)												1.0543 (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	2.6496 (42)
Average daily hot water use (litres/day)	97.1272 (43)

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

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Energy conte	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy content (annual)	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1528.1885 (45)
	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (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	14.1368	12.7579	14.0966	13.5976	14.0187	13.5294	13.9572	13.9971	13.5665	14.0643	13.6519	14.1248 (61)
Total heat required for water heating calculated for each month	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (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	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (64)
								Total per year (kWh/year) =	Sum (64)m =			1693.6873 (64)
Heat gains from water heating, kWh/month	56.2157	49.2650	51.0700	44.8510	43.2785	37.7041	35.2935	39.9950	40.3232	46.5563	50.3948	54.5504 (65)

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
	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6037	21.8528	17.7719	13.4545	10.0574	8.4909	9.1747	11.9256	16.0065	20.3239	23.7210	25.2875 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.3505	244.8654	238.5281	225.0367	208.0062	192.0000	181.3068	178.7920	185.1293	198.6207	215.6512	231.6574 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478 (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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826 (71)
Water heating gains (Table 5)	75.5587	73.3110	68.6424	62.2931	58.1700	52.3668	47.4375	53.7567	56.0045	62.5757	69.9927	73.3204 (72)
Total internal gains	408.2564	405.7727	390.6859	366.5277	341.9770	318.6011	303.6624	310.2178	322.8838	347.2638	375.1084	396.0088 (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				4.4000	10.6334		0.4500	0.0000		0.7700	16.2117 (74)	
South				4.7500	46.7521		0.4500	0.0000		0.7700	76.9481 (78)	
West				0.6500	19.6403		0.4500	0.0000		0.7700	4.4235 (80)	

Solar gains	97.5832	165.6557	227.4240	286.7770	328.4463	329.9680	316.4499	284.2936	247.5613	183.0726	116.7244	83.6427 (83)
Total gains	505.8396	571.4283	618.1099	653.3046	670.4233	648.5691	620.1123	594.5114	570.4451	530.3364	491.8328	479.6515 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	60.0628	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337
util living area	5.0042	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156
	0.9980	0.9959	0.9908	0.9756	0.9298	0.8139	0.6501	0.6952	0.8919	0.9805	0.9959	0.9985 (86)
MIT	19.7529	19.8941	20.1157	20.4034	20.6907	20.8978	20.9747	20.9645	20.8223	20.4561	20.0436	19.7175 (87)
Th 2	20.0361	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386 (88)
util rest of house	0.9973	0.9946	0.9877	0.9664	0.9006	0.7364	0.5253	0.5740	0.8368	0.9715	0.9944	0.9980 (89)
MIT 2	18.8932	19.0359	19.2562	19.5393	19.8115	19.9842	20.0308	20.0264	19.9298	19.5933	19.1853	18.8599 (90)
Living area fraction									fLA = Living area / (4) =			0.2375 (91)
MIT	19.0974	19.2397	19.4603	19.7445	20.0203	20.2011	20.2549	20.2492	20.1417	19.7982	19.3892	19.0636 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9474	19.0897	19.3103	19.5945	19.8703	20.0511	20.1049	20.0992	19.9917	19.6482	19.2392	18.9136 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9963	0.9928	0.9845	0.9608	0.8943	0.7376	0.5346	0.5823	0.8335	0.9665	0.9926	0.9972 (94)
Useful gains	503.9835	567.2977	608.5114	627.7098	599.5616	478.3683	331.4857	346.1988	475.4645	512.5440	488.1827	478.2921 (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	1421.3007	1372.9852	1239.5179	1034.7882	790.5488	527.4484	339.1359	357.9318	570.0794	875.5003	1174.5758	1423.6733 (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	682.4840	541.4220	469.4688	293.0964	142.0945	0.0000	0.0000	0.0000	0.0000	270.0395	494.2030	703.3636 (98)
Space heating												3596.1718 (98)
Space heating per m2										(98) / (4) =		39.1740 (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	3973.6705 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	682.4840	541.4220	469.4688	293.0964	142.0945	0.0000	0.0000	0.0000	0.0000	270.0395	494.2030	703.3636 (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)	754.1259	598.2563	518.7501	323.8635	157.0105	0.0000	0.0000	0.0000	0.0000	298.3862	546.0807	777.1973 (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	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (64)
Efficiency of water heater (217)m	89.8354	89.7811	89.6759	89.4491	88.9203	87.3000	87.3000	87.3000	87.3000	89.3633	89.7150	89.8662 (217)
Fuel for water heating, kWh/month	192.1039	168.5554	175.1770	154.5730	150.2909	133.7374	125.5542	141.7625	142.7710	160.5902	172.7141	186.4615 (219)
Water heating fuel used	1904.2911 (219)											
Annual totals kWh/year												
Space heating fuel - main system	3973.6705 (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)	61.2049 (230a)											
central heating pump	30.0000 (230c)											
main heating flue fan	45.0000 (230e)											
Total electricity for the above, kWh/year	136.2049 (231)											
Electricity for lighting (calculated in Appendix L)	434.5090 (232)											
Energy saving/generation technologies (Appendices M, N and Q)												
PV Unit 0 (0.80 * 0.90 * 720 * 1.00) =	-518.0724											
Total delivered energy for all uses	5930.6032 (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	3973.6705	0.2160	858.3128 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1904.2911	0.2160	411.3269 (264)
Space and water heating			1269.6397 (265)
Pumps and fans	136.2049	0.5190	70.6903 (267)
Energy for lighting	434.5090	0.5190	225.5102 (268)
Energy saving/generation technologies			
PV Unit	-518.0724	0.5190	-268.8796 (269)
Total CO2, kg/year			1296.9607 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1300 (273)

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

DER	14.1300	ZC1
Total Floor Area	91.8000	
Assumed number of occupants	2.6496	
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	
CO2 emissions from appliances, equation (L14)	15.6440	ZC2
CO2 emissions from cooking, equation (L16)	1.9890	ZC3
Total CO2 emissions	31.7630	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	31.7630	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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
															Air changes per hour		
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1294 (8)
Pressure test																Yes	
Measured/design AP50																	5.0000
Infiltration rate																	0.3794 (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) =		0.3225 (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	0.4112	0.4031	0.3951	0.3548	0.3467	0.3064	0.3064	0.2983	0.3225	0.3467	0.3628	0.3790	(22b)				
Effective ac	0.5845	0.5813	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5718	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Semi-glazed door			2.1000	1.2000	2.5200			(26a)					
TER Opening Type (Uw = 1.40)			9.8000	1.3258	12.9924			(27)					
ground			45.9000	0.1300	5.9670			(28a)					
external	96.9600	14.0000	82.9600	0.1800	14.9328			(29a)					
cd	45.9000		45.9000	0.1300	5.9670			(30)					
Total net area of external elements Aum(A, m2)			188.7600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4792			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6740	(36)					
Total fabric heat loss						(33) + (36) =	54.1532	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 44.7131	Feb 44.4620	Mar 44.2158	Apr 43.0597	May 42.8434	Jun 41.8364	Jul 41.8364	Aug 41.6499	Sep 42.2243	Oct 42.8434	Nov 43.2810	Dec 43.7385	(38)
Heat transfer coeff	98.8663	98.6152	98.3691	97.2129	96.9966	95.9896	95.9896	95.8032	96.3775	96.9966	97.4342	97.8917	(39)
Average = Sum(39)m / 12 =												97.2119	(39)
HLP	Jan 1.0770	Feb 1.0742	Mar 1.0716	Apr 1.0590	May 1.0566	Jun 1.0456	Jul 1.0456	Aug 1.0436	Sep 1.0499	Oct 1.0566	Nov 1.0614	Dec 1.0664	(40)
HLP (average)												1.0590	(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												2.6496 (42)
Average daily hot water use (litres/day)												97.1272 (43)
Daily hot water use	Jan 106.8399	Feb 102.9548	Mar 99.0697	Apr 95.1846	May 91.2995	Jun 87.4145	Jul 87.4145	Aug 91.2995	Sep 95.1846	Oct 99.0697	Nov 102.9548	Dec 106.8399 (44)
Energy conte	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Energy content (annual)										Total = Sum(45)m =		1528.1885 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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	50.9589	46.0274	50.4848	46.9404	46.5252	43.1085	44.5454	46.5252	46.9404	50.4848	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.3994	184.6004	193.4798	171.6068	166.1457	146.3319	140.1971	156.2869	158.0129	179.9292	190.6137	204.4000 (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	209.3994	184.6004	193.4798	171.6068	166.1457	146.3319	140.1971	156.2869	158.0129	179.9292	190.6137	204.4000 (64)
Heat gains from water heating, kWh/month	65.4212	57.5824	60.1670	53.1867	51.4051	45.0989	42.9405	48.1271	48.6667	55.6614	59.3106	63.7589 (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	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6037	21.8528	17.7719	13.4545	10.0574	8.4909	9.1747	11.9256	16.0065	20.3239	23.7210	25.2875 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.3505	244.8654	238.5281	225.0367	208.0062	192.0000	181.3068	178.7920	185.1293	198.6207	215.6512	231.6574 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478 (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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826 (71)
Water heating gains (Table 5)	87.9317	85.6881	80.8697	73.8704	69.0929	62.6373	57.7158	64.6869	67.5926	74.8138	82.3758	85.6974 (72)
Total internal gains	420.6294	418.1497	402.9131	378.1050	352.8999	328.8716	313.9407	321.1479	334.4719	359.5018	387.4914	408.3858 (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				4.4000	10.6334		0.6300		0.7000		0.7700	14.2987 (74)
South				4.7500	46.7521		0.6300		0.7000		0.7700	67.8682 (78)
West				0.6500	19.6403		0.6300		0.7000		0.7700	3.9015 (80)
Solar gains	86.0684	146.1083	200.5880	252.9373	289.6897	291.0318	279.1088	250.7470	218.3491	161.4700	102.9509	73.7729 (83)
Total gains	506.6978	564.2580	603.5011	631.0423	642.5896	619.9034	593.0496	571.8949	552.8210	520.9719	490.4423	482.1587 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.4810	64.6452	64.8070	65.5777	65.7239	66.4134	66.4134	66.5427	66.1461	65.7239	65.4288	65.1230
alpha	5.2987	5.3097	5.3205	5.3718	5.3816	5.4276	5.4276	5.4362	5.4097	5.3816	5.3619	5.3415
util living area	0.9987	0.9973	0.9940	0.9833	0.9476	0.8406	0.6756	0.7179	0.9105	0.9860	0.9972	0.9990 (86)
MIT	19.8128	19.9368	20.1422	20.4219	20.6949	20.9027	20.9774	20.9685	20.8316	20.4847	20.1003	19.7919 (87)
Th 2	20.0197	20.0219	20.0241	20.0345	20.0364	20.0455	20.0455	20.0472	20.0420	20.0364	20.0325	20.0284 (88)
util rest of house	0.9982	0.9964	0.9918	0.9763	0.9225	0.7645	0.5471	0.5939	0.8585	0.9787	0.9961	0.9987 (89)
MIT 2	18.4277	18.6104	18.9117	19.3239	19.7075	19.9710	20.0359	20.0323	19.8923	19.4184	18.8575	18.4034 (90)
Living area fraction	18.7566	18.9254	19.2039	19.5846	19.9420	20.1922	20.2594	20.2546	20.1153	19.6716	19.1526	18.7331 (92)
Temperature adjustment	18.7566	18.9254	19.2039	19.5846	19.9420	20.1922	20.2594	20.2546	20.1153	19.6716	19.1526	18.7331 (93)
adjusted MIT	18.7566	18.9254	19.2039	19.5846	19.9420	20.1922	20.2594	20.2546	20.1153	19.6716	19.1526	18.7331 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9973	0.9949	0.9891	0.9718	0.9194	0.7779	0.5777	0.6231	0.8633	0.9748	0.9946	0.9980 (94)
Ext temp.	505.3522	561.3882	596.9439	613.2684	590.8247	482.2078	342.6243	356.3743	477.2688	507.8500	487.7865	481.1728 (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	1429.2688	1383.1159	1249.6722	1038.6856	799.4419	536.7974	351.2683	369.2834	579.7431	879.9159	1174.3356	1422.6726 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	687.3940	552.2010	485.6298	306.3004	155.2112	0.0000	0.0000	0.0000	0.0000	276.8170	494.3154	700.4759 (98)
Space heating	3658.3447 (98)											
Space heating per m2	(98) / (4) = 39.8512 (99)											

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3916.8573 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	687.3940	552.2010	485.6298	306.3004	155.2112	0.0000	0.0000	0.0000	0.0000	276.8170	494.3154	700.4759	(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)	735.9678	591.2217	519.9463	327.9448	166.1790	0.0000	0.0000	0.0000	0.0000	296.3780	529.2456	749.9742	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	209.3994	184.6004	193.4798	171.6068	166.1457	146.3319	140.1971	156.2869	158.0129	179.9292	190.6137	204.4000	(64)
Efficiency of water heater (217)m	87.8208	87.6383	87.2726	86.4936	84.8803	80.3000	80.3000	80.3000	80.3000	86.1323	87.3427	87.9025	(216)
Fuel for water heating, kWh/month	238.4394	210.6391	221.6959	198.4042	195.7411	182.2314	174.5916	194.6287	196.7782	208.8987	218.2366	232.5303	(219)
Water heating fuel used												2472.8152	(219)
Annual totals kWh/year													
Space heating fuel - main system												3916.8573	(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)												434.5090	(232)
Total delivered energy for all uses												6899.1814	(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	3916.8573	0.2160	846.0412 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2472.8152	0.2160	534.1281 (264)
Space and water heating			1380.1692 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	434.5090	0.5190	225.5102 (268)
Total CO2, kg/m2/year			1644.6044 (272)
Emissions per m2 for space and water heating			15.0345 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4565 (272b)
Emissions per m2 for pumps and fans			0.4240 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0345 * 1.00) + 2.4565 + 0.4240, rounded to 2 d.p.			17.9200 (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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1294 (8)
Pressure test					Yes
Measured/design AP50					4.6800
Infiltration rate					0.3634 (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) =	0.3089 (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	0.3939	0.3861	0.3784	0.3398	0.3321	0.2935	0.2935	0.2857	0.3089	0.3321	0.3475	0.3630 (22b)
Effective ac	0.5776	0.5746	0.5716	0.5577	0.5551	0.5431	0.5431	0.5408	0.5477	0.5551	0.5604	0.5659 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 20981.4000 (34)
228.5556 (35)
7.5245 (36)
(33) + (36) = 58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.1792	43.9488	43.7230	42.6623	42.4638	41.5400	41.5400	41.3689	41.8959	42.4638	42.8653	43.2850 (38)
Heat transfer coeff	102.6923	102.4619	102.2361	101.1754	100.9770	100.0531	100.0531	99.8821	100.4090	100.9770	101.3784	101.7981 (39)
Average = Sum(39)m / 12 =												101.1745 (39)
HLP	1.1187	1.1161	1.1137	1.1021	1.1000	1.0899	1.0899	1.0880	1.0938	1.1000	1.1043	1.1089 (40)
HLP (average)												1.1021 (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												2.6496 (42)
Average daily hot water use (litres/day)												97.1272 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy conte	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Energy content (annual)										Total = Sum(45)m =		1528.1885 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.6686	29.4468	30.3864	26.4916	25.4193	21.9350	20.3260	23.3243	23.6029	27.5069	30.0260	32.6062 (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	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6037	21.8528	17.7719	13.4545	10.0574	8.4909	9.1747	11.9256	16.0065	20.3239	23.7210	25.2875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.3505	244.8654	238.5281	225.0367	208.0062	192.0000	181.3068	178.7920	185.1293	198.6207	215.6512	231.6574	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	(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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	(71)
Water heating gains (Table 5)	45.2535	43.8196	40.8420	36.7939	34.1658	30.4652	27.3198	31.3499	32.7818	36.9717	41.7027	43.8256	(72)
Total internal gains	374.9512	373.2812	359.8854	338.0285	314.9728	293.6995	280.5448	284.8110	296.6611	318.6597	343.8183	363.5140	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g or Table 6b		FF or Table 6c		Access factor Table 6d		Gains W
North				4.4000	10.6334		0.4500		0.0000		0.7700		16.2117 (74)
South				4.7500	46.7521		0.4500		0.0000		0.7700		76.9481 (78)
West				0.6500	19.6403		0.4500		0.0000		0.7700		4.4235 (80)
Solar gains	97.5832	165.6557	227.4240	286.7770	328.4463	329.9680	316.4499	284.2936	247.5613	183.0726	116.7244	83.6427	(83)
Total gains	472.5344	538.9369	587.3094	624.8055	643.4192	623.6675	596.9947	569.1046	544.2224	501.7324	460.5428	447.1567	(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	56.7537	56.8813	57.0069	57.6046	57.7178	58.2507	58.2507	58.3505	58.0443	57.7178	57.4892	57.2522	
alpha	4.7836	4.7921	4.8005	4.8403	4.8479	4.8834	4.8834	4.8900	4.8696	4.8479	4.8326	4.8168	
util living area	0.9985	0.9968	0.9929	0.9807	0.9435	0.8408	0.6849	0.7311	0.9126	0.9853	0.9970	0.9988	(86)
MIT	19.6273	19.7710	20.0060	20.3226	20.6320	20.8712	20.9652	20.9518	20.7823	20.3840	19.9480	19.6020	(87)
Th 2	19.9856	19.9877	19.9897	19.9991	20.0009	20.0091	20.0091	20.0106	20.0059	20.0009	19.9973	19.9936	(88)
util rest of house	0.9980	0.9958	0.9904	0.9731	0.9181	0.7663	0.5548	0.6069	0.8632	0.9780	0.9958	0.9985	(89)
MIT 2	18.7277	18.8727	19.1082	19.4286	19.7266	19.9388	19.9981	19.9937	19.8692	19.4926	19.0573	18.7088	(90)
Living area fraction	18.9413	19.0860	19.3214	19.6409	19.9416	20.1602	20.2278	20.2212	20.0860	19.7043	19.2688	18.9209	(91)
MIT	18.9413	19.0860	19.3214	19.6409	19.9416	20.1602	20.2278	20.2212	20.0860	19.7043	19.2688	18.9209	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9413	19.0860	19.3214	19.6409	19.9416	20.1602	20.2278	20.2212	20.0860	19.7043	19.2688	18.9209	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	471.2565	536.0068	580.3733	605.8298	589.5140	486.0763	349.7347	361.9788	472.4114	489.2713	458.0669	446.2297	(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	1503.5499	1453.5276	1310.8124	1086.7188	832.2095	556.3202	362.9708	381.6712	601.0491	919.3256	1233.6531	1498.5608	(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	768.0263	616.5740	543.4466	346.2400	180.5655	0.0000	0.0000	0.0000	0.0000	319.9604	558.4220	782.9344	(98)
Space heating												4116.1692	(98)
Space heating per m2												44.8384	(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	940.4995	740.3932	759.1036	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7746	0.8592	0.8344	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	728.5223	636.1583	633.4012	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	830.4746	797.2785	766.8471	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	73.4057	119.8735	99.2837	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												292.5629 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	18.3514	29.9684	24.8209	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												73.1407 (107)
Space cooling per m2												0.7967 (108)
Energy for space heating												44.8384 (99)
Energy for space cooling												0.7967 (108)
Total												45.6352 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
															Air changes per hour		
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1294 (8)
Pressure test																Yes	
Measured/design AP50																	5.0000
Infiltration rate																	0.3794 (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) =		0.3225 (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	0.4112	0.4031	0.3951	0.3548	0.3467	0.3064	0.3064	0.2983	0.3225	0.3467	0.3628	0.3790	(22b)				
Effective ac	0.5845	0.5813	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5718	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Semi-glazed door			2.1000	1.2000	2.5200			(26a)					
TER Opening Type (Uw = 1.40)			9.8000	1.3258	12.9924			(27)					
ground			45.9000	0.1300	5.9670			(28a)					
external	96.9600	14.0000	82.9600	0.1800	14.9328			(29a)					
cd	45.9000		45.9000	0.1300	5.9670			(30)					
Total net area of external elements Aum(A, m2)			188.7600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4792			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6740	(36)					
Total fabric heat loss						(33) + (36) =	54.1532	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 44.7131	Feb 44.4620	Mar 44.2158	Apr 43.0597	May 42.8434	Jun 41.8364	Jul 41.8364	Aug 41.6499	Sep 42.2243	Oct 42.8434	Nov 43.2810	Dec 43.7385	(38)
Heat transfer coeff	98.8663	98.6152	98.3691	97.2129	96.9966	95.9896	95.9896	95.8032	96.3775	96.9966	97.4342	97.8917	(39)
Average = Sum(39)m / 12 =												97.2119	(39)
HLP	Jan 1.0770	Feb 1.0742	Mar 1.0716	Apr 1.0590	May 1.0566	Jun 1.0456	Jul 1.0456	Aug 1.0436	Sep 1.0499	Oct 1.0566	Nov 1.0614	Dec 1.0664	(40)
HLP (average)												1.0590	(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												2.6496 (42)
Average daily hot water use (litres/day)												97.1272 (43)
Daily hot water use	Jan 106.8399	Feb 102.9548	Mar 99.0697	Apr 95.1846	May 91.2995	Jun 87.4145	Jul 87.4145	Aug 91.2995	Sep 95.1846	Oct 99.0697	Nov 102.9548	Dec 106.8399 (44)
Energy conte	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Energy content (annual)										Total = Sum(45)m =		1528.1885 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.6686	29.4468	30.3864	26.4916	25.4193	21.9350	20.3260	23.3243	23.6029	27.5069	30.0260	(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	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	132.4782	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6037	21.8528	17.7719	13.4545	10.0574	8.4909	9.1747	11.9256	16.0065	20.3239	23.7210	25.2875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.3505	244.8654	238.5281	225.0367	208.0062	192.0000	181.3068	178.7920	185.1293	198.6207	215.6512	231.6574	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	36.2478	(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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	(71)
Water heating gains (Table 5)	45.2535	43.8196	40.8420	36.7939	34.1658	30.4652	27.3198	31.3499	32.7818	36.9717	41.7027	43.8256	(72)
Total internal gains	374.9512	373.2812	359.8854	338.0285	314.9728	293.6995	280.5448	284.8110	296.6611	318.6597	343.8183	363.5140	(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				4.4000	10.6334	0.6300	0.7000	0.7700	14.2987 (74)				
South				4.7500	46.7521	0.6300	0.7000	0.7700	67.8682 (78)				
West				0.6500	19.6403	0.6300	0.7000	0.7700	3.9015 (80)				
Solar gains	86.0684	146.1083	200.5880	252.9373	289.6897	291.0318	279.1088	250.7470	218.3491	161.4700	102.9509	73.7729	(83)
Total gains	461.0196	519.3896	560.4734	590.9658	604.6625	584.7313	559.6537	535.5579	515.0101	480.1298	446.7693	437.2868	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	64.4810	64.6452	64.8070	65.5777	65.7239	66.4134	66.4134	66.5427	66.1461	65.7239	65.4288	65.1230		
alpha	5.2987	5.3097	5.3205	5.3718	5.3816	5.4276	5.4276	5.4362	5.4097	5.3816	5.3619	5.3415		
util living area	0.9992	0.9982	0.9958	0.9875	0.9585	0.8645	0.7066	0.7522	0.9298	0.9903	0.9982	0.9994	(86)	
MIT	19.7657	19.8908	20.0989	20.3834	20.6643	20.8865	20.9720	20.9605	20.8060	20.4450	20.0555	19.7455	(87)	
Th 2	20.0197	20.0219	20.0241	20.0345	20.0364	20.0455	20.0455	20.0472	20.0420	20.0364	20.0325	20.0284	(88)	
util rest of house	0.9989	0.9976	0.9942	0.9820	0.9374	0.7935	0.5766	0.6286	0.8851	0.9850	0.9975	0.9992	(89)	
MIT 2	18.8857	19.0125	19.2217	19.5122	19.7848	19.9842	20.0371	20.0339	19.9202	19.5760	19.1856	18.8726	(90)	
Living area fraction														
MIT	19.0947	19.2210	19.4300	19.7191	19.9937	20.1985	20.2591	20.2539	20.1306	19.7824	19.3922	19.0799	(92)	
Temperature adjustment														
adjusted MIT	19.0947	19.2210	19.4300	19.7191	19.9937	20.1985	20.2591	20.2539	20.1306	19.7824	19.3922	19.0799	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9969	0.9928	0.9797	0.9363	0.8067	0.6080	0.6582	0.8902	0.9831	0.9968	0.9989	(94)
Useful gains	460.3236	517.7659	556.4451	578.9579	566.1201	471.6955	340.2486	352.5083	458.4690	472.0141	445.3507	436.7919	(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	1462.6987	1412.2718	1271.9108	1051.7544	804.4570	537.3964	351.2336	369.2183	581.2121	890.6588	1197.6813	1456.6174	(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	745.7671	601.1080	532.3065	340.4135	177.3227	0.0000	0.0000	0.0000	0.0000	311.4717	541.6781	758.7502	(98)
Space heating												4008.8177	(98)
Space heating per m2												(98) / (4) =	43.6690 (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	902.3027	710.3234	728.1041	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7802	0.8683	0.8444	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	703.9522	616.7606	614.7798	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	784.9647	753.6331	727.6367	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	58.3290	101.8331	83.9655	0.0000	0.0000	0.0000	0.0000	(104)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												244.1277 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	14.5823	25.4583	20.9914	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												61.0319 (107)
Space cooling per m2												0.6648 (108)
Energy for space heating												43.6690 (99)
Energy for space cooling												0.6648 (108)
Total												44.3339 (109)
Target Fabric Energy Efficiency (TFEE)												51.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	231.7950 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour	
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50												4.6800	
Infiltration rate												0.2340 (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) =			0.1989 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)	
Adj infilt rate	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)	
Mechanical extract ventilation - decentralised	0.2337	0.2188	0.2188	0.1989	0.2039	0.1939	0.1939	0.1890	0.1890	0.2039	0.1989	0.2039 (22b)	
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20981.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.5556 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5245 (36)
Total fabric heat loss						(33) + (36) =	58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462 (38)
Heat transfer coeff	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593 (39)
Average = Sum(39)m / 12 =												96.7593 (39)
HLP	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540 (40)
HLP (average)												1.0540 (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	2.6496 (42)
Average daily hot water use (litres/day)	97.1272 (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	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy content (annual)	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (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	14.1368	12.7579	14.0966	13.5976	14.0187	13.5294	13.9572	13.9971	13.5665	14.0643	13.6519	14.1248 (61)
Total heat required for water heating calculated for each month	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (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	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (64)
RHI water heating demand	56.2157	49.2650	51.0700	44.8510	43.2785	37.7041	35.2935	39.9950	40.3232	46.5563	50.3948	54.5504 (65)
Heat gains from water heating, kWh/month												1694 (64)
												1694 (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	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5092	54.6320	44.4297	33.6361	25.1434	21.2271	22.9367	29.8139	40.0162	50.8098	59.3025	63.2188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.7172	365.4707	356.0120	335.8756	310.4570	286.5671	270.6072	266.8537	276.3124	296.4488	321.8674	345.7573 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470 (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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826 (71)
Water heating gains (Table 5)	75.5587	73.3110	68.6424	62.2931	58.1700	52.3668	47.4375	53.7567	56.0045	62.5757	69.9927	73.3204 (72)
Total internal gains	608.3234	602.9520	578.6224	541.3431	503.3087	469.6993	450.5196	459.9626	481.8714	519.3725	560.7009	591.8347 (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				4.4000	13.4684	0.4500	0.0000		0.7700		20.5339 (74)	
South				4.7500	56.5862	0.4500	0.0000		0.7700		93.1338 (78)	
West				0.6500	25.1733	0.4500	0.0000		0.7700		5.6696 (80)	
Solar gains	119.3374	172.5942	242.3242	309.4442	335.9895	374.6241	344.7543	321.2692	277.0033	206.0681	142.2970	96.8302 (83)
Total gains	727.6608	775.5461	820.9466	850.7872	839.2982	844.3234	795.2739	781.2318	758.8746	725.4406	702.9978	688.6649 (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	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337
alpha	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156
util living area	0.9858	0.9794	0.9604	0.9093	0.7925	0.5674	0.3990	0.3940	0.6706	0.8964	0.9705	0.9884 (86)
MIT	20.1357	20.2263	20.4317	20.6856	20.8890	20.9839	20.9978	20.9980	20.9631	20.7641	20.4211	20.1055 (87)
Th 2	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386 (88)
util rest of house	0.9815	0.9733	0.9481	0.8804	0.7292	0.4683	0.2842	0.2769	0.5733	0.8567	0.9599	0.9848 (89)
MIT 2	19.2748	19.3635	19.5630	19.8007	19.9722	20.0329	20.0382	20.0383	20.0232	19.8745	19.5554	19.2453 (90)
Living area fraction									fLA = Living area / (4) =			0.2375 (91)
MIT	19.4792	19.5684	19.7693	20.0109	20.1899	20.2587	20.2661	20.2662	20.2464	20.0858	19.7610	19.4496 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3292	19.4184	19.6193	19.8609	20.0399	20.1087	20.1161	20.1162	20.0964	19.9358	19.6110	19.2996 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9773	0.9682	0.9415	0.8741	0.7293	0.4758	0.2935	0.2865	0.5796	0.8516	0.9540	0.9811 (94)
Useful gains	711.1428	750.8764	772.9516	743.6683	612.1216	401.7247	233.4242	223.8072	439.8285	617.7934	670.6266	675.6423 (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	1328.4289	1298.3559	1162.9801	944.4554	671.5013	407.2339	233.7799	224.1119	454.4203	758.1841	1065.4180	1315.8883 (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	459.2609	367.9063	290.1812	144.5667	44.1785	0.0000	0.0000	0.0000	0.0000	104.4507	284.2498	476.3431 (98)
Space heating												2171.1371 (98)
RHI space heating demand												2171 (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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6800
Infiltration rate												0.2340 (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) =	0.1989 (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	0.2536	0.2486	0.2437	0.2188	0.2138	0.1890	0.1890	0.1840	0.1989	0.2138	0.2238	0.2337 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5036	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20981.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.5556 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5245 (36)
Total fabric heat loss						(33) + (36) =	58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5214	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462 (38)
Heat transfer coeff	97.0345	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593 (39)
Average = Sum(39)m / 12 =												96.7822 (39)
HLP	1.0570	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540 (40)
HLP (average)												1.0543 (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	2.6496 (42)
Average daily hot water use (litres/day)	97.1272 (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	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy content (annual)	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (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	14.1368	12.7579	14.0966	13.5976	14.0187	13.5294	13.9572	13.9971	13.5665	14.0643	13.6519	14.1248 (61)
Total heat required for water heating calculated for each month	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (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	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (64)
Heat gains from water heating, kWh/month	56.2157	49.2650	51.0700	44.8510	43.2785	37.7041	35.2935	39.9950	40.3232	46.5563	50.3948	54.5504 (65)

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	61.5092	54.6320	44.4297	33.6361	25.1434	21.2271	22.9367	29.8139	40.0162	50.8098	59.3025	63.2188 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	361.7172	365.4707	356.0120	335.8756	310.4570	286.5671	270.6072	266.8537	276.3124	296.4488	321.8674	345.7573 (68)
Pumps, fans	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826 (71)
Total internal gains	75.5587	73.3110	68.6424	62.2931	58.1700	52.3668	47.4375	53.7567	56.0045	62.5757	69.9927	73.3204 (72)
	608.3234	602.9520	578.6224	541.3431	503.3087	469.6993	450.5196	459.9626	481.8714	519.3725	560.7009	591.8347 (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				4.4000	10.6334	0.4500	0.0000	0.7700	16.2117 (74)			
South				4.7500	46.7521	0.4500	0.0000	0.7700	76.9481 (78)			
West				0.6500	19.6403	0.4500	0.0000	0.7700	4.4235 (80)			
Solar gains	97.5832	165.6557	227.4240	286.7770	328.4463	329.9680	316.4499	284.2936	247.5613	183.0726	116.7244	83.6427 (83)
Total gains	705.9066	768.6076	806.0465	828.1201	831.7550	799.6673	766.9695	744.2562	729.4326	702.4451	677.4253	675.4774 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	60.0628	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337
util living area	5.0042	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156
	0.9911	0.9851	0.9726	0.9411	0.8648	0.7127	0.5418	0.5789	0.7948	0.9438	0.9838	0.9928 (86)
MIT	19.9707	20.1045	20.3076	20.5622	20.7980	20.9448	20.9886	20.9841	20.9017	20.6160	20.2411	19.9320 (87)
Th 2	20.0361	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386 (88)
util rest of house	0.9886	0.9809	0.9644	0.9223	0.8208	0.6281	0.4301	0.4671	0.7214	0.9220	0.9784	0.9907 (89)
MIT 2	19.1093	19.2435	19.4428	19.6874	19.8998	20.0117	20.0353	20.0336	19.9845	19.7415	19.3796	19.0730 (90)
Living area fraction	19.3139	19.4480	19.6482	19.8951	20.1131	20.2333	20.2617	20.2594	20.2023	19.9492	19.5842	19.2770 (92)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	19.1639	19.2980	19.4982	19.7451	19.9631	20.0833	20.1117	20.1094	20.0523	19.7992	19.4342	19.1270 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9855	0.9766	0.9586	0.9153	0.8169	0.6323	0.4388	0.4757	0.7226	0.9153	0.9739	0.9881 (94)
Ext temp.	695.6751	750.6560	772.6685	758.0018	679.4335	505.6392	336.5778	354.0618	527.0922	642.9657	659.7314	667.4442 (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	1442.3095	1393.1361	1257.6981	1049.3669	799.5288	530.5602	339.7912	358.9142	575.9380	890.1054	1193.4500	1444.3246 (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	555.4960	431.7466	360.8621	209.7829	89.3509	0.0000	0.0000	0.0000	0.0000	183.8719	384.2774	577.9990 (98)
Space heating per m2												2793.3868 (98)
												(98) / (4) = 30.4291 (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													3086.6153 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	555.4960	431.7466	360.8621	209.7829	89.3509	0.0000	0.0000	0.0000	0.0000	183.8719	384.2774	577.9990	(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)	613.8077	477.0681	398.7426	231.8043	98.7303	0.0000	0.0000	0.0000	0.0000	203.1734	424.6160	638.6729	(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													
Efficiency of water heater (217)m	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659	(64)
Fuel for water heating, kWh/month	89.7205	89.6471	89.5050	89.2011	88.5547	87.3000	87.3000	87.3000	87.3000	89.0688	89.5567	89.7605	(216)
Water heating fuel used	192.3500	168.8073	175.5115	155.0027	150.9114	133.7374	125.5542	141.7625	142.7710	161.1210	173.0195	186.6811	(219)
Annual totals kWh/year												1907.2296	(219)
Space heating fuel - main system												3086.6153	(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)												61.2049	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												136.2049	(231)
Electricity for lighting (calculated in Appendix L)												434.5090	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 720 * 1.00) =										-518.0724		-518.0724	(233)
Total delivered energy for all uses												5046.4864	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3086.6153	3.4800	107.4142 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1907.2296	3.4800	66.3716 (247)
Mechanical ventilation fans	61.2049	13.1900	8.0729 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	434.5090	13.1900	57.3117 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-518.0724	13.1900	-68.3337 (252)
Total energy cost			300.7292 (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] =	0.9233 (257)
SAP value		87.1201
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	3086.6153	0.2160	666.7089 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1907.2296	0.2160	411.9616 (264)
Space and water heating			1078.6705 (265)
Pumps and fans	136.2049	0.5190	70.6903 (267)
Energy for lighting	434.5090	0.5190	225.5102 (268)
Energy saving/generation technologies			
PV Unit	-518.0724	0.5190	-268.8796 (269)
Total kg/year			1105.9914 (272)
CO2 emissions per m2			12.0500 (273)
EI value			89.1665
EI rating			89 (274)
EI band			B

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6800
Infiltration rate												0.2340 (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) =	0.1989 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.2337	0.2188	0.2188	0.1989	0.2039	0.1939	0.1939	0.1890	0.1890	0.2039	0.1989	0.2039 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20981.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.5556 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5245 (36)
Total fabric heat loss						(33) + (36) =	58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462 (38)
Heat transfer coeff	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593 (39)
Average = Sum(39)m / 12 =												96.7593 (39)
HLP	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540 (40)
HLP (average)												1.0540 (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	2.6496 (42)
Average daily hot water use (litres/day)	97.1272 (43)

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

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Calculation Type: New Build (As Built)

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

Energy conte	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy content (annual)	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (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	14.1368	12.7579	14.0966	13.5976	14.0187	13.5294	13.9572	13.9971	13.5665	14.0643	13.6519	14.1248 (61)
Total heat required for water heating calculated for each month	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (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	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (64)
Heat gains from water heating, kWh/month	56.2157	49.2650	51.0700	44.8510	43.2785	37.7041	35.2935	39.9950	40.3232	46.5563	50.3948	54.5504 (65)

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	61.5092	54.6320	44.4297	33.6361	25.1434	21.2271	22.9367	29.8139	40.0162	50.8098	59.3025	63.2188 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	361.7172	365.4707	356.0120	335.8756	310.4570	286.5671	270.6072	266.8537	276.3124	296.4488	321.8674	345.7573 (68)
Pumps, fans	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826 (71)
Total internal gains	75.5587	73.3110	68.6424	62.2931	58.1700	52.3668	47.4375	53.7567	56.0045	62.5757	69.9927	73.3204 (72)
	608.3234	602.9520	578.6224	541.3431	503.3087	469.6993	450.5196	459.9626	481.8714	519.3725	560.7009	591.8347 (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				4.4000	13.4684	0.4500	0.0000	0.7700	20.5339 (74)			
South				4.7500	56.5862	0.4500	0.0000	0.7700	93.1338 (78)			
West				0.6500	25.1733	0.4500	0.0000	0.7700	5.6696 (80)			
Solar gains	119.3374	172.5942	242.3242	309.4442	335.9895	374.6241	344.7543	321.2692	277.0033	206.0681	142.2970	96.8302 (83)
Total gains	727.6608	775.5461	820.9466	850.7872	839.2982	844.3234	795.2739	781.2318	758.8746	725.4406	702.9978	688.6649 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337
util living area	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156
	0.9858	0.9794	0.9604	0.9093	0.7925	0.5674	0.3990	0.3940	0.6706	0.8964	0.9705	0.9884 (86)
MIT	20.1357	20.2263	20.4317	20.6856	20.8890	20.9839	20.9978	20.9980	20.9631	20.7641	20.4211	20.1055 (87)
Th 2	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386 (88)
util rest of house	0.9815	0.9733	0.9481	0.8804	0.7292	0.4683	0.2842	0.2769	0.5733	0.8567	0.9599	0.9848 (89)
MIT 2	19.2748	19.3635	19.5630	19.8007	19.9722	20.0329	20.0382	20.0383	20.0232	19.8745	19.5554	19.2453 (90)
Living area fraction	19.4792	19.5684	19.7693	20.0109	20.1899	20.2587	20.2661	20.2662	20.2464	20.0858	19.7610	19.4496 (92)
MIT	19.4792	19.5684	19.7693	20.0109	20.1899	20.2587	20.2661	20.2662	20.2464	20.0858	19.7610	19.4496 (92)
Temperature adjustment	19.3292	19.4184	19.6193	19.8609	20.0399	20.1087	20.1161	20.1162	20.0964	19.9358	19.6110	-0.1500
adjusted MIT	19.3292	19.4184	19.6193	19.8609	20.0399	20.1087	20.1161	20.1162	20.0964	19.9358	19.6110	19.2996 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9773	0.9682	0.9415	0.8741	0.7293	0.4758	0.2935	0.2865	0.5796	0.8516	0.9540	0.9811 (94)
Ext temp.	711.1428	750.8764	772.9516	743.6683	612.1216	401.7247	233.4242	223.8072	439.8285	617.7934	670.6266	675.6423 (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	1328.4289	1298.3559	1162.9801	944.4554	671.5013	407.2339	233.7799	224.1119	454.4203	758.1841	1065.4180	1315.8883 (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	459.2609	367.9063	290.1812	144.5667	44.1785	0.0000	0.0000	0.0000	0.0000	104.4507	284.2498	476.3431 (98)
Space heating per m2												2171.1371 (98)
										(98) / (4) =		23.6507 (99)

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Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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													2399.0465 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.2609	367.9063	290.1812	144.5667	44.1785	0.0000	0.0000	0.0000	0.0000	104.4507	284.2498	476.3431	(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)	507.4706	406.5263	320.6422	159.7422	48.8160	0.0000	0.0000	0.0000	0.0000	115.4152	314.0881	526.3459	(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	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659	(64)
Efficiency of water heater	89.6029	89.5434	89.3497	88.9069	88.0737	87.3000	87.3000	87.3000	87.3000	88.6200	89.3446	89.6449	(216)
(217)m													(217)
Fuel for water heating, kWh/month	192.6023	169.0028	175.8165	155.5156	151.7355	133.7374	125.5542	141.7625	142.7710	161.9372	173.4302	186.9219	(219)
Water heating fuel used												1910.7872	(219)
Annual totals kWh/year													
Space heating fuel - main system												2399.0465	(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)												61.2049	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												136.2049	(231)
Electricity for lighting (calculated in Appendix L)												434.5090	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.90 + 842 + 1.00) =										-605.9410		-605.9410	(233)
Total delivered energy for all uses												4274.6066	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2399.0465	9.7400	233.6671 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1910.7872	9.7400	186.1107 (247)
Mechanical ventilation fans	61.2049	36.8500	22.5540 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	434.5090	36.8500	160.1166 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-605.9410	36.8500	-223.2893 (252)
Total energy cost			510.7966 (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	2399.0465	0.2160	518.1940 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1910.7872	0.2160	412.7300 (264)
Space and water heating			930.9241 (265)
Pumps and fans	136.2049	0.5190	70.6903 (267)
Energy for lighting	434.5090	0.5190	225.5102 (268)
Energy saving/generation technologies			
PV Unit	-605.9410	0.5190	-314.4834 (269)
Total kg/year			912.6412 (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	2399.0465	1.2200	2926.8367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1910.7872	1.2200	2331.1604 (264)
Space and water heating			5257.9971 (265)
Pumps and fans	136.2049	3.0700	418.1491 (267)
Energy for lighting	434.5090	3.0700	1333.9426 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-605.9410	3.0700	-1860.2389 (269)
Primary energy kWh/year			5149.8499 (272)
Primary energy kWh/m2/year			56.0986 (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	+ 1.2	-£ 79	-191 kg (20.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79 2.08 kg/m²	B 88	B 91
Total Savings	£79 2.08 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 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	£210	£229	-£18
Mains gas	£524	£426	£98
Space heating	£388	£388	£0
Water heating	£186	£107	£79
Lighting	£160	£160	£0
Generated (PV)	-£223	-£223	£0
Total cost of fuels	£511	£432	£80
Total cost of uses	£511	£432	£79
Delivered energy	47 kWh/m²	36 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	44 kWh/m²	12 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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (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					4.6800
Infiltration rate					0.2340 (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) =	0.1989 (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	0.2536	0.2486	0.2437	0.2188	0.2138	0.1890	0.1890	0.1840	0.1989	0.2138	0.2238	0.2337 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5036	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20981.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.5556 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5245 (36)
Total fabric heat loss						(33) + (36) =	58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5214	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462 (38)
Heat transfer coeff	97.0345	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593 (39)
Average = Sum(39)m / 12 =												96.7822 (39)
HLP	1.0570	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540 (40)
HLP (average)												1.0543 (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	2.6496 (42)
Average daily hot water use (litres/day)	97.1272 (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 FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy content (annual)	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1528.1885 (45)
	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (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	14.1368	12.7579	14.0966	13.5976	14.0187	13.5294	13.9572	13.9971	13.5665	14.0643	13.6519	14.1248 (61)
Total heat required for water heating calculated for each month	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (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												1.1868 (H8)
Utilisation factor												0.5694 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.1272 (H14)
Volume ratio Veff/V												0.7722 (H15)
Solar storage volume factor												0.9483 (H16)
Solar input												-861.0979 (H17)
Solar input	-24.9701	-41.6680	-70.9653	-95.1075	-117.4973	-115.5186	-113.9919	-99.5953	-78.0031	-53.2669	-29.6182	-20.8957 (63)
								Solar input (sum of months) =	Sum (63)m =			-861.0979 (63)
Output from w/h	147.6072	109.6629	86.1262	43.1566	16.1418	1.2342	0.0000	24.1634	46.6360	90.2417	125.3324	146.6702 (64)
								Total per year (kWh/year) =	Sum (64)m =			836.9725 (64)
Heat gains from water heating, kWh/month	56.2157	49.2650	51.0700	44.8510	43.2785	37.7041	35.2935	39.9950	40.3232	46.5563	50.3948	54.5504 (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	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5092	54.6320	44.4297	33.6361	25.1434	21.2271	22.9367	29.8139	40.0162	50.8098	59.3025	63.2188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.7172	365.4707	356.0120	335.8756	310.4570	286.5671	270.6072	266.8537	276.3124	296.4488	321.8674	345.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	(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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	(71)
Water heating gains (Table 5)	75.5587	73.3110	68.6424	62.2931	58.1700	52.3668	47.4375	53.7567	56.0045	62.5757	69.9927	73.3204	(72)
Total internal gains	608.3234	602.9520	578.6224	541.3431	503.3087	469.6993	450.5196	459.9626	481.8714	519.3725	560.7009	591.8347	(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	4.4000	10.6334	0.4500	0.0000	0.7700	16.2117 (74)
South	4.7500	46.7521	0.4500	0.0000	0.7700	76.9481 (78)
West	0.6500	19.6403	0.4500	0.0000	0.7700	4.4235 (80)

Solar gains	97.5832	165.6557	227.4240	286.7770	328.4463	329.9680	316.4499	284.2936	247.5613	183.0726	116.7244	83.6427 (83)
Total gains	705.9066	768.6076	806.0465	828.1201	831.7550	799.6673	766.9695	744.2562	729.4326	702.4451	677.4253	675.4774 (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	60.0628	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337
alpha	5.0042	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156
util living area												
	0.9911	0.9851	0.9726	0.9411	0.8648	0.7127	0.5418	0.5789	0.7948	0.9438	0.9838	0.9928 (86)
MIT	19.9707	20.1045	20.3076	20.5622	20.7980	20.9448	20.9886	20.9841	20.9017	20.6160	20.2411	19.9320 (87)
Th 2	20.0361	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386 (88)
util rest of house												
	0.9886	0.9809	0.9644	0.9223	0.8208	0.6281	0.4301	0.4671	0.7214	0.9220	0.9784	0.9907 (89)
MIT 2	19.1093	19.2435	19.4428	19.6874	19.8998	20.0117	20.0353	20.0336	19.9845	19.7415	19.3796	19.0730 (90)
Living area fraction									fLA = Living area / (4) =			0.2375 (91)
MIT	19.3139	19.4480	19.6482	19.8951	20.1131	20.2333	20.2617	20.2594	20.2023	19.9492	19.5842	19.2770 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1639	19.2980	19.4982	19.7451	19.9631	20.0833	20.1117	20.1094	20.0523	19.7992	19.4342	19.1270 (93)

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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	0.9855	0.9766	0.9586	0.9153	0.8169	0.6323	0.4388	0.4757	0.7226	0.9153	0.9739	0.9881	(94)
Useful gains	695.6751	750.6560	772.6685	758.0018	679.4335	505.6392	336.5778	354.0618	527.0922	642.9657	659.7314	667.4442	(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	1442.3095	1393.1361	1257.6981	1049.3669	799.5288	530.5602	339.7912	358.9142	575.9380	890.1054	1193.4500	1444.3246	(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	555.4960	431.7466	360.8621	209.7829	89.3509	0.0000	0.0000	0.0000	0.0000	183.8719	384.2774	577.9990	(98)
Space heating												2793.3868	(98)
Space heating per m2											(98) / (4) =	30.4291	(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													3086.6153	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	555.4960	431.7466	360.8621	209.7829	89.3509	0.0000	0.0000	0.0000	0.0000	183.8719	384.2774	577.9990	(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)	613.8077	477.0681	398.7426	231.8043	98.7303	0.0000	0.0000	0.0000	0.0000	203.1734	424.6160	638.6729	(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	147.6072	109.6629	86.1262	43.1566	16.1418	1.2342	0.0000	24.1634	46.6360	90.2417	125.3324	146.6702	(64)	
Efficiency of water heater	89.8089	89.8330	89.8653	89.9375	89.9952	87.3000	87.3000	87.3000	87.3000	89.4209	89.6914	89.8335	(216)	
(217)m	89.8089	89.8330	89.8653	89.9375	89.9952	87.3000	87.3000	87.3000	87.3000	89.4209	89.6914	89.8335	(217)	
Fuel for water heating, kWh/month	164.3569	122.0742	95.8392	47.9851	17.9363	1.4137	0.0000	27.6785	53.4203	100.9179	139.7372	163.2689	(219)	
Water heating fuel used												934.6283	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3086.6153	(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)													61.2049	(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													186.2049	(231)
Electricity for lighting (calculated in Appendix L)													434.5090	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.90 * 720 * 1.00) =										-518.0724			-518.0724	(233)
Total delivered energy for all uses													4123.8852	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3086.6153	3.4800	107.4142	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	934.6283	3.4800	32.5251	(247)
Mechanical ventilation fans	61.2049	13.1900	8.0729	(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	434.5090	13.1900	57.3117	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-518.0724	13.1900	-68.3337	(252)
Total energy cost			273.4777	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8396	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.2872	
SAP rating (Section 12)		88	(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	3086.6153	0.2160	666.7089 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	934.6283	0.2160	201.8797 (264)
Space and water heating			868.5886 (265)
Pumps and fans	186.2049	0.5190	96.6403 (267)
Energy for lighting	434.5090	0.5190	225.5102 (268)
Energy saving/generation technologies			
PV Unit	-518.0724	0.5190	-268.8796 (269)
Total kg/year			921.8596 (272)
CO2 emissions per m2			10.0400 (273)
EI value			90.9701
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	45.9000 (1b)	x 2.4500 (2b)	= 112.4550 (1b) - (3b)
First floor	45.9000 (1c)	x 2.6000 (2c)	= 119.3400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.7950 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour	
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test											Yes		
Measured/design AP50												4.6800	
Infiltration rate												0.2340 (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) =			0.1989 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)	
Adj infilt rate	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)	
	0.2337	0.2188	0.2188	0.1989	0.2039	0.1939	0.1939	0.1890	0.1890	0.2039	0.1989	0.2039 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
rear			2.1000	1.4000	2.9400		(26a)
front (Uw = 1.40)			9.8000	1.3258	12.9924		(27)
ground			45.9000	0.1200	5.5080	75.0000	3442.5001 (28a)
external	96.9600	14.0000	82.9600	0.2700	22.3992	150.0000	12443.9999 (29a)
cd	45.9000		45.9000	0.1100	5.0490	9.0000	413.1000 (30)
Total net area of external elements Aum(A, m ²)			188.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9886		(33)
party			44.4400	0.0000	0.0000	45.0000	1999.7999 (32)
stud			160.3000			9.0000	1442.7000 (32c)
internal			45.9000			18.0000	826.2000 (32d)
internal			45.9000			9.0000	413.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20981.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.5556 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5245 (36)
Total fabric heat loss						(33) + (36) =	58.5131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462	38.2462 (38)
Heat transfer coeff	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593	96.7593 (39)
Average = Sum(39)m / 12 =												96.7593 (39)
HLP	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540	1.0540 (40)
HLP (average)												1.0540 (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	2.6496 (42)
Average daily hot water use (litres/day)	97.1272 (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	106.8399	102.9548	99.0697	95.1846	91.2995	87.4145	87.4145	91.2995	95.1846	99.0697	102.9548	106.8399 (44)
Energy content (annual)	158.4405	138.5730	142.9950	124.6665	119.6205	103.2234	95.6516	109.7616	111.0725	129.4443	141.2986	153.4411 (45)
Distribution loss (46)m = 0.15 x (45)m												1528.1885 (45)
	23.7661	20.7860	21.4492	18.7000	17.9431	15.4835	14.3477	16.4642	16.6609	19.4166	21.1948	23.0162 (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	14.1368	12.7579	14.0966	13.5976	14.0187	13.5294	13.9572	13.9971	13.5665	14.0643	13.6519	14.1248 (61)
Total heat required for water heating calculated for each month	172.5773	151.3309	157.0915	138.2641	133.6391	116.7527	109.6088	123.7587	124.6391	143.5087	154.9505	167.5659 (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												1.3258 (H8)
Utilisation factor												0.5296 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.1272 (H14)
Volume ratio Veff/V												0.7722 (H15)
Solar storage volume factor												0.9483 (H16)
Solar input												-894.7791 (H17)
Solar input	-29.1978	-41.5225	-72.0523	-96.9225	-112.6305	-122.5093	-116.1575	-105.9243	-82.9068	-57.3022	-34.5343	-23.1193 (63)
												-894.7791 (63)
Solar input (sum of months) = Sum (63)m =												
Output from w/h	143.3795	109.8084	85.0392	41.3416	21.0087	0.0000	0.0000	17.8343	41.7323	86.2065	120.4162	144.4467 (64)
												811.2134 (64)
Total per year (kWh/year) = Sum (64)m =												
Heat gains from water heating, kWh/month	56.2157	49.2650	51.0700	44.8510	43.2785	37.7041	35.2935	39.9950	40.3232	46.5563	50.3948	54.5504 (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	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	158.9739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5092	54.6320	44.4297	33.6361	25.1434	21.2271	22.9367	29.8139	40.0162	50.8098	59.3025	63.2188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.7172	365.4707	356.0120	335.8756	310.4570	286.5671	270.6072	266.8537	276.3124	296.4488	321.8674	345.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	53.5470	(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)	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	-105.9826	(71)
Water heating gains (Table 5)	75.5587	73.3110	68.6424	62.2931	58.1700	52.3668	47.4375	53.7567	56.0045	62.5757	69.9927	73.3204	(72)
Total internal gains	608.3234	602.9520	578.6224	541.3431	503.3087	469.6993	450.5196	459.9626	481.8714	519.3725	560.7009	591.8347	(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	4.4000	13.4684	0.4500	0.0000	0.7700	20.5339 (74)
South	4.7500	56.5862	0.4500	0.0000	0.7700	93.1338 (78)
West	0.6500	25.1733	0.4500	0.0000	0.7700	5.6696 (80)

Solar gains	119.3374	172.5942	242.3242	309.4442	335.9895	374.6241	344.7543	321.2692	277.0033	206.0681	142.2970	96.8302 (83)
Total gains	727.6608	775.5461	820.9466	850.7872	839.2982	844.3234	795.2739	781.2318	758.8746	725.4406	702.9978	688.6649 (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	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337	60.2337
alpha	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156	5.0156
util living area												
	0.9858	0.9794	0.9604	0.9093	0.7925	0.5674	0.3990	0.3940	0.6706	0.8964	0.9705	0.9884 (86)
MIT	20.1357	20.2263	20.4317	20.6856	20.8890	20.9839	20.9978	20.9980	20.9631	20.7641	20.4211	20.1055 (87)
Th 2	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386	20.0386 (88)
util rest of house												
	0.9815	0.9733	0.9481	0.8804	0.7292	0.4683	0.2842	0.2769	0.5733	0.8567	0.9599	0.9848 (89)
MIT 2	19.2748	19.3635	19.5630	19.8007	19.9722	20.0329	20.0382	20.0383	20.0232	19.8745	19.5554	19.2453 (90)
Living area fraction									fLA = Living area / (4) =			0.2375 (91)
MIT	19.4792	19.5684	19.7693	20.0109	20.1899	20.2587	20.2661	20.2662	20.2464	20.0858	19.7610	19.4496 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3292	19.4184	19.6193	19.8609	20.0399	20.1087	20.1161	20.1162	20.0964	19.9358	19.6110	19.2996 (93)

FULL SAP CALCULATION PRINTOUT

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	0.9773	0.9682	0.9415	0.8741	0.7293	0.4758	0.2935	0.2865	0.5796	0.8516	0.9540	0.9811	(94)
Useful gains	711.1428	750.8764	772.9516	743.6683	612.1216	401.7247	233.4242	223.8072	439.8285	617.7934	670.6266	675.6423	(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	1328.4289	1298.3559	1162.9801	944.4554	671.5013	407.2339	233.7799	224.1119	454.4203	758.1841	1065.4180	1315.8883	(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	459.2609	367.9063	290.1812	144.5667	44.1785	0.0000	0.0000	0.0000	0.0000	104.4507	284.2498	476.3431	(98)
Space heating												2171.1371	(98)
Space heating per m2												(98) / (4) =	23.6507 (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													2399.0465 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.2609	367.9063	290.1812	144.5667	44.1785	0.0000	0.0000	0.0000	0.0000	104.4507	284.2498	476.3431	(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)	507.4706	406.5263	320.6422	159.7422	48.8160	0.0000	0.0000	0.0000	0.0000	115.4152	314.0881	526.3459	(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	143.3795	109.8084	85.0392	41.3416	21.0087	0.0000	0.0000	17.8343	41.7323	86.2065	120.4162	144.4467	(64)
Efficiency of water heater	89.7176	89.7439	89.7544	89.7683	89.4434	87.3000	87.3000	87.3000	87.3000	89.0245	89.5235	89.7347	(216)
(217)m	89.7176	89.7439	89.7544	89.7683	89.4434	87.3000	87.3000	87.3000	87.3000	89.0245	89.5235	89.7347	(217)
Fuel for water heating, kWh/month	159.8120	122.3575	94.7466	46.0537	23.4882	0.0000	0.0000	20.4288	47.8033	96.8345	134.5079	160.9709	(219)
Water heating fuel used												907.0036	(219)
Annual totals kWh/year													
Space heating fuel - main system												2399.0465	(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)													61.2049 (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													186.2049 (231)
Electricity for lighting (calculated in Appendix L)													434.5090 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 842 * 1.00) =										-605.9410		-605.9410	(233)
Total delivered energy for all uses												3320.8229	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2399.0465	9.7400	233.6671	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	907.0036	9.7400	88.3421	(247)
Mechanical ventilation fans	61.2049	36.8500	22.5540	(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	434.5090	36.8500	160.1166	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-605.9410	36.8500	-223.2893	(252)
Total energy cost			431.4531	(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	2399.0465	0.2160	518.1940	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	907.0036	0.2160	195.9128	(264)
Space and water heating			714.1068	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	186.2049	0.5190	96.6403 (267)
Energy for lighting	434.5090	0.5190	225.5102 (268)
Energy saving/generation technologies			
PV Unit	-605.9410	0.5190	-314.4834 (269)
Total kg/year			721.7739 (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	2399.0465	1.2200	2926.8367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	907.0036	1.2200	1106.5443 (264)
Space and water heating			4033.3811 (265)
Pumps and fans	186.2049	3.0700	571.6491 (267)
Energy for lighting	434.5090	3.0700	1333.9426 (268)
Energy saving/generation technologies			
PV Unit	-605.9410	3.0700	-1860.2389 (269)
Primary energy kWh/year			4078.7338 (272)
Primary energy kWh/m2/year			44.4307 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	228.6 (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	305.97 (P1)
Transmission heat loss coefficient	58.51 (37)
Summer heat loss coefficient	364.48 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.4000	87.1704	0.4500	0.0000	0.9000	155.3377
South	4.7500	118.5567	0.4500	0.0000	0.9000	228.0734
West	0.6500	125.2818	0.4500	0.0000	0.9000	32.9804
total:						416.3915

	Jun	Jul	Aug	
Solar gains	445	416	380	(P4)
Internal gains	467	448	457	
Total summer gains	912	864	837	(P5)
Summer gain/loss ratio	2.50	2.37	2.30	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 228.6)	0.40	0.40	0.40	
Threshold temperature	18.30	20.07	20.00	(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 22	Issued on Date	15/05/2023
Assessment Reference	plot 22 hamblewood	Prop Type Ref	21809
Property	41 Alder Avenue, Hedge End, Southampton, SO30 0AS		
SAP Rating	87 B	DER	14.13
Environmental	89 B	% DER<TER	21.13
CO ₂ Emissions (t/year)	0.91	DFEE	45.64
General Requirements Compliance	Pass	% DFEE<TFEE	10.49
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
Client	AU40-0001		

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)	17.92	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.13	kgCO ₂ /m ²	Pass
	-3.79 (-21.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.98	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.64	kWh/m ² /yr	
	-5.4 (-10.6%)	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	1.34 (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	4.68 (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

4.40 m², No overhang

Windows facing South

4.75 m², No overhang

Windows facing West

0.65 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

4.68 (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

0.90

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.