

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 86			Issued on Date	10/08/2023
Assessment Reference	86 Hamble	Prop Type Ref	21809		
Property	4 Hickory Way, Hedge End, Southampton, SO30 0AW				
SAP Rating	87 B	DER	14.21	TER	19.10
Environmental	90 B	% DER<TER	25.60		
CO ₂ Emissions (t/year)	0.69	DFEE	47.25	TFEE	52.53
General Requirements Compliance	Pass	% DFEE<TFEE	10.05		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

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

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DWELLING AS BUILT

End-Terrace House, total floor area 70 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) 19.10 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.3 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: 4.62 (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): Slight OK

Based on:

Overshading: Average
Windows facing North: 0.65 m², No overhang
Windows facing East: 6.35 m², No overhang
Windows facing West: 4.20 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 0.74 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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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					4.6200
Infiltration rate					0.2310 (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)	=	0.1964 (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	0.2503	0.2454	0.2405	0.2160	0.2111	0.1865	0.1865	0.1816	0.1964	0.2111	0.2209	0.2307 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5003	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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (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	29.1839	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	80.5076	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4891 (39)
HLP	1.1501	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)

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Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum(45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	343.8959	341.8617	329.4487	309.5236	289.4101	269.9816	257.3439	263.0430	273.2713	293.3963	316.4813	333.6833 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				0.6500	10.6334	0.4500	0.0000	0.7700		2.3949 (74)		
East				6.3500	19.6403	0.4500	0.0000	0.7700		43.2140 (76)		
West				4.2000	19.6403	0.4500	0.0000	0.7700		28.5825 (80)		
Solar gains	74.1914	145.0259	239.0767	349.8287	430.2467	441.2225	419.7301	359.4384	278.3616	172.1027	92.4762	61.0384 (83)
Total gains	418.0872	486.8876	568.5254	659.3524	719.6568	711.2040	677.0740	622.4814	551.6329	465.4991	408.9575	394.7217 (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	60.7349	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0490	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9981	0.9955	0.9863	0.9502	0.8507	0.6786	0.5134	0.5765	0.8375	0.9764	0.9961	0.9986 (86)
MIT	19.7618	19.9167	20.1902	20.5361	20.8179	20.9566	20.9913	20.9848	20.8753	20.4891	20.0499	19.7206 (87)
Th 2	19.9601	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9975	0.9940	0.9813	0.9320	0.8000	0.5865	0.3971	0.4554	0.7633	0.9645	0.9944	0.9981 (89)
MIT 2	18.8334	18.9878	19.2586	19.5921	19.8413	19.9413	19.9582	19.9562	19.8927	19.5538	19.1211	18.7924 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.0084	19.1630	19.4342	19.7702	20.0255	20.1327	20.1530	20.1502	20.0780	19.7302	19.2962	18.9674 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8584	19.0130	19.2842	19.6202	19.8755	19.9827	20.0030	20.0002	19.9280	19.5802	19.1462	18.8174 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9965	0.9920	0.9770	0.9245	0.7952	0.5887	0.4020	0.4602	0.7605	0.9585	0.9926	0.9973 (94)
Ext temp.	416.6075	483.0066	555.4475	609.5995	572.2893	418.6595	272.2060	286.4780	419.5439	446.1912	405.9176	393.6646 (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	1172.0656	1135.9187	1028.9706	862.8375	658.0224	433.2425	273.9019	289.7687	469.0813	722.7900	969.5705	1176.5189 (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	562.0608	438.7569	352.3012	182.3314	63.7854	0.0000	0.0000	0.0000	0.0000	205.7895	405.8301	582.4436 (98)
Space heating per m2												2793.2989 (98)
										(98) / (4) =		39.9043 (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													3086.5182 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	562.0608	438.7569	352.3012	182.3314	63.7854	0.0000	0.0000	0.0000	0.0000	205.7895	405.8301	582.4436	(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)	621.0617	484.8143	389.2831	201.4712	70.4811	0.0000	0.0000	0.0000	0.0000	227.3917	448.4310	643.5841	(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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater	89.7818	89.7149	89.5527	89.1649	88.3741	87.3000	87.3000	87.3000	87.3000	89.2297	89.6528	87.3000	(216)
Fuel for water heating, kWh/month	174.7534	153.3816	159.5945	141.2127	137.8111	122.0263	114.7023	129.3075	130.1650	146.4547	157.2240	169.6558	(219)
Water heating fuel used												1736.2889	(219)
Annual totals kWh/year													
Space heating fuel - main system												3086.5182	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													47.3439 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													122.3439 (231)
Electricity for lighting (calculated in Appendix L)													324.0744 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =													-537.4497 (233)
Total delivered energy for all uses													4731.7756 (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	3086.5182	0.2160	666.6879 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1736.2889	0.2160	375.0384 (264)
Space and water heating			1041.7263 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total CO2, kg/year			994.4810 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2100 (273)

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

DER			14.2100 ZC1
Total Floor Area		TFA	70.0000
Assumed number of occupants		N	2.2461
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.7020 ZC2
CO2 emissions from cooking, equation (L16)			2.4701 ZC3
Total CO2 emissions			33.3821 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			33.3821 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (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) =					20.0000	/ (5) =	0.1132 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3632 (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) =					0.3087 (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	0.3936	0.3859	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3473	0.3627	(22b)				
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658	(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 Opening Type (Uw = 1.40)			11.2000	1.3258	14.8485		(27)						
ground			35.0000	0.1300	4.5500		(28a)						
external	84.8400	13.3000	71.5400	0.1800	12.8772		(29a)						
cd	35.0000		35.0000	0.1300	4.5500		(30)						
Total net area of external elements Aum(A, m2)			154.8400				(31)						
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		38.9257		(33)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7810 (36)						
Total fabric heat loss						(33) + (36) =	47.7067 (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	33.6811	33.5057	33.3337	32.5261	32.3750	31.6717	31.6717	31.5414	31.9426	32.3750	32.6807	33.0003 (38)	
Heat transfer coeff	81.3878	81.2124	81.0404	80.2328	80.0817	79.3783	79.3783	79.2481	79.6493	80.0817	80.3874	80.7070 (39)	
Average = Sum(39)m / 12 =												80.2321 (39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1627	1.1602	1.1577	1.1462	1.1440	1.1340	1.1340	1.1321	1.1378	1.1440	1.1484	1.1530 (40)	
HLP (average)												1.1462 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	49.0734	42.7126	45.5045	42.3096	41.9355	38.8558	40.1510	41.9355	42.3096	45.5045	45.7635	49.0734 (61)
Solar input	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (64)
	59.7527	52.2083	54.2315	47.9398	46.3339	40.6498	38.7044	43.3793	43.8657	50.1704	53.7879	58.2544 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	80.3128	77.6909	72.8918	66.5830	62.2768	56.4581	52.0220	58.3055	60.9246	67.4333	74.7053	78.2990	(72)
Total internal gains	355.6522	353.0259	340.0238	319.5116	298.8073	278.7896	266.1582	272.4461	283.2681	303.9803	327.6505	345.4431	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.6500	10.6334	0.6300	0.7000	0.7700		2.1123 (74)	
East					6.3500	19.6403	0.6300	0.7000	0.7700		38.1147 (76)	
West					4.2000	19.6403	0.6300	0.7000	0.7700		25.2097 (80)	
Solar gains	65.4368	127.9128	210.8657	308.5490	379.4776	389.1582	370.2019	317.0247	245.5150	151.7946	81.5640	53.8359 (83)
Total gains	421.0890	480.9387	550.8895	628.0606	678.2849	667.9478	636.3602	589.4708	528.7831	455.7749	409.2144	399.2790 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7278	59.8568	59.9838	60.5876	60.7019	61.2398	61.2398	61.3404	61.0315	60.7019	60.4711	60.2316	
alpha	4.9819	4.9905	4.9989	5.0392	5.0468	5.0827	5.0827	5.0894	5.0688	5.0468	5.0314	5.0154	
util living area	0.9980	0.9957	0.9878	0.9576	0.8711	0.7047	0.5368	0.5968	0.8509	0.9778	0.9959	0.9985	(86)
MIT	19.7432	19.8903	20.1547	20.5041	20.7932	20.9498	20.9897	20.9829	20.8660	20.4800	20.0474	19.7164	(87)
Th 2	19.9500	19.9520	19.9540	19.9633	19.9650	19.9732	19.9732	19.9747	19.9700	19.9650	19.9615	19.9578	(88)
util rest of house	0.9973	0.9942	0.9834	0.9416	0.8242	0.6133	0.4178	0.4745	0.7799	0.9666	0.9943	0.9979	(89)
MIT 2	18.2761	18.4922	18.8775	19.3807	19.7628	19.9399	19.9694	19.9676	19.8614	19.3563	18.7290	18.2426	(90)
Living area fraction	18.5528	18.7558	19.1184	19.5926	19.9571	20.1304	20.1618	20.1591	20.0509	19.5682	18.9776	18.5206	(91)
MIT	18.5528	18.7558	19.1184	19.5926	19.9571	20.1304	20.1618	20.1591	20.0509	19.5682	18.9776	18.5206	(92)
Temperature adjustment	18.5528	18.7558	19.1184	19.5926	19.9571	20.1304	20.1618	20.1591	20.0509	19.5682	18.9776	18.5206	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	419.3628	476.9547	539.0625	586.8352	558.7882	419.6638	280.1681	293.2576	415.8386	437.8477	405.9020	398.0118	(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	1160.0024	1125.2654	1022.5990	857.8947	661.2435	438.9905	282.7301	297.9003	473.9835	718.1912	954.8100	1155.7691	(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	551.0359	435.6648	359.7511	195.1629	76.2267	0.0000	0.0000	0.0000	0.0000	208.5756	395.2137	563.7714	(98)
Space heating												2785.4021	(98)
Space heating per m2												39.7915	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2982.2293 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	551.0359	435.6648	359.7511	195.1629	76.2267	0.0000	0.0000	0.0000	0.0000	208.5756	395.2137	563.7714 (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)	589.9742	466.4505	385.1725	208.9538	81.6132	0.0000	0.0000	0.0000	0.0000	223.3143	423.1411	603.6096 (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	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (64)
Efficiency of water heater (217)m	87.5556	87.3475	86.8341	85.6376	83.4447	80.3000	80.3000	80.3000	80.3000	85.6856	87.0642	80.3000 (216)
Fuel for water heating, kWh/month	219.1562	191.8947	200.8344	180.6189	179.4664	164.2541	157.3679	175.4284	177.3658	189.2720	198.8449	213.7794 (219)
Water heating fuel used												2248.2831 (219)
Annual totals kWh/year												
Space heating fuel - main system												2982.2293 (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)												324.0744 (232)
Total delivered energy for all uses												5629.5867 (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	2982.2293	0.2160	644.1615 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2248.2831	0.2160	485.6291 (264)
Space and water heating			1129.7907 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Total CO2, kg/m2/year			1336.9103 (272)
Emissions per m2 for space and water heating			16.1399 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4028 (272b)
Emissions per m2 for pumps and fans			0.5561 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1399 * 1.00) + 2.4028 + 0.5561, rounded to 2 d.p.			19.1000 (273)

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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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1132 (8)
Pressure test					Yes
Measured/design AP50					4.6200
Infiltration rate					0.3442 (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) =	0.2925 (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	0.3730	0.3657	0.3584	0.3218	0.3145	0.2779	0.2779	0.2706	0.2925	0.3145	0.3291	0.3437 (22b)
Effective ac	0.5696	0.5669	0.5642	0.5518	0.5494	0.5386	0.5386	0.5366	0.5428	0.5494	0.5542	0.5591 (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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3143		(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (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) = 17602.6495 (34)
251.4664 (35)
7.0094 (36)
(33) + (36) = 51.3237 (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	33.2208	33.0632	32.9088	32.1835	32.0478	31.4161	31.4161	31.2991	31.6594	32.0478	32.3223	32.6093 (38)
Heat transfer coeff	84.5445	84.3869	84.2325	83.5072	83.3715	82.7398	82.7398	82.6228	82.9831	83.3715	83.6460	83.9330 (39)
Average = Sum(39)m / 12 =												83.5065 (39)
HLP	Jan 1.2078	Feb 1.2055	Mar 1.2033	Apr 1.1930	May 1.1910	Jun 1.1820	Jul 1.1820	Aug 1.1803	Sep 1.1855	Oct 1.1910	Nov 1.1949	Dec 1.1990 (40)
HLP (average)												1.1930 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)												Total = Sum(45)m = 1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	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	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
Total internal gains	313.1286	311.8317	300.9449	283.0928	264.3258	246.7913	235.7609	239.3978	248.8914	266.8713	287.5338	303.6463	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				0.6500	10.6334	0.4500	0.0000	0.7700		2.3949 (74)		
East				6.3500	19.6403	0.4500	0.0000	0.7700		43.2140 (76)		
West				4.2000	19.6403	0.4500	0.0000	0.7700		28.5825 (80)		

Solar gains	74.1914	145.0259	239.0767	349.8287	430.2467	441.2225	419.7301	359.4384	278.3616	172.1027	92.4762	61.0384 (83)
Total gains	387.3199	456.8576	540.0217	632.9215	694.5725	688.0137	655.4910	598.8362	527.2530	438.9741	380.0100	364.6847 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8350	57.9429	58.0491	58.5533	58.6486	59.0964	59.0964	59.1801	58.9231	58.6486	58.4562	58.2563	
alpha	4.8557	4.8629	4.8699	4.9036	4.9099	4.9398	4.9398	4.9453	4.9282	4.9099	4.8971	4.8838	
util living area	0.9986	0.9967	0.9894	0.9598	0.8730	0.7080	0.5414	0.6084	0.8637	0.9822	0.9972	0.9990	(86)
MIT	19.6452	19.8057	20.0912	20.4660	20.7760	20.9437	20.9879	20.9791	20.8445	20.4222	19.9618	19.6157	(87)
Th 2	19.9138	19.9156	19.9173	19.9256	19.9272	19.9344	19.9344	19.9358	19.9316	19.9272	19.9240	19.9208	(88)
util rest of house	0.9982	0.9955	0.9855	0.9441	0.8255	0.6139	0.4175	0.4806	0.7938	0.9728	0.9960	0.9986	(89)
MIT 2	18.6801	18.8416	19.1264	19.4974	19.7780	19.9092	19.9315	19.9300	19.8449	19.4624	19.0045	18.6562	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	18.8621	19.0234	19.3083	19.6801	19.9662	20.1043	20.1307	20.1278	20.0334	19.6434	19.1850	18.8372	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8621	19.0234	19.3083	19.6801	19.9662	20.1043	20.1307	20.1278	20.0334	19.6434	19.1850	18.8372	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9975	0.9942	0.9825	0.9397	0.8275	0.6300	0.4411	0.5048	0.8016	0.9694	0.9948	0.9981	(94)
Ext temp.	386.3521	454.1885	530.5868	594.7497	574.7804	433.4699	289.1130	302.3101	422.6704	425.5425	378.0346	364.0035	(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	1231.1453	1191.8290	1078.8785	900.2125	689.1676	455.4207	292.1267	308.0029	492.3684	753.9634	1010.8613	1228.5421	(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	628.5261	495.6944	407.9290	219.9332	85.1041	0.0000	0.0000	0.0000	0.0000	244.3452	455.6352	643.2167	(98)
Space heating per m2												3180.3839	(98)
										(98) / (4) =		45.4341	(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	777.7539	612.2744	627.9332	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8916	0.9350	0.9092	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	685.6851	572.5062	570.9130	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	887.9455	848.2715	783.5069	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	145.6275	205.1694	158.1699	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												508.9668 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	36.4069	51.2924	39.5425	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												127.2417 (107)
Space cooling per m2												1.8177 (108)
Energy for space heating												45.4341 (99)
Energy for space cooling												1.8177 (108)
Total												47.2518 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.3 (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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (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) =					20.0000	/ (5) =	0.1132 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3632 (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) =					0.3087 (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	0.3936	0.3859	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3473	0.3627	(22b)				
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658	(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 Opening Type (Uw = 1.40)			11.2000	1.3258	14.8485		(27)						
ground			35.0000	0.1300	4.5500		(28a)						
external	84.8400	13.3000	71.5400	0.1800	12.8772		(29a)						
cd	35.0000		35.0000	0.1300	4.5500		(30)						
Total net area of external elements Aum(A, m2)			154.8400				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	38.9257		(33)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7810 (36)						
Total fabric heat loss						(33) + (36) =	47.7067 (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	33.6811	33.5057	33.3337	32.5261	32.3750	31.6717	31.6717	31.5414	31.9426	32.3750	32.6807	33.0003 (38)	
Heat transfer coeff	81.3878	81.2124	81.0404	80.2328	80.0817	79.3783	79.3783	79.2481	79.6493	80.0817	80.3874	80.7070 (39)	
Average = Sum(39)m / 12 =												80.2321 (39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1627	1.1602	1.1577	1.1462	1.1440	1.1340	1.1340	1.1321	1.1378	1.1440	1.1484	1.1530 (40)	
HLP (average)												1.1462 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
Total internal gains	313.1286	311.8317	300.9449	283.0928	264.3258	246.7913	235.7609	239.3978	248.8914	266.8713	287.5338	303.6463	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					0.6500	10.6334	0.6300	0.7000			0.7700			2.1123 (74)
East					6.3500	19.6403	0.6300	0.7000			0.7700			38.1147 (76)
West					4.2000	19.6403	0.6300	0.7000			0.7700			25.2097 (80)
Solar gains	65.4368	127.9128	210.8657	308.5490	379.4776	389.1582	370.2019	317.0247	245.5150	151.7946	81.5640	53.8359 (83)		
Total gains	378.5653	439.7445	511.8106	591.6417	643.8034	635.9495	605.9629	556.4225	494.4064	418.6660	369.0978	357.4822 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nilm (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.7278	59.8568	59.9838	60.5876	60.7019	61.2398	61.2398	61.3404	61.0315	60.7019	60.4711	60.2316		
alpha	4.9819	4.9905	4.9989	5.0392	5.0468	5.0827	5.0827	5.0894	5.0688	5.0468	5.0314	5.0154		
util living area	0.9988	0.9971	0.9911	0.9661	0.8890	0.7300	0.5610	0.6267	0.8761	0.9843	0.9975	0.9991	(86)	
MIT	19.6868	19.8362	20.1052	20.4640	20.7684	20.9411	20.9875	20.9787	20.8434	20.4349	19.9945	19.6608	(87)	
Th 2	19.9500	19.9520	19.9540	19.9633	19.9650	19.9732	19.9732	19.9747	19.9700	19.9650	19.9615	19.9578	(88)	
util rest of house	0.9983	0.9961	0.9878	0.9527	0.8460	0.6389	0.4380	0.5009	0.8110	0.9760	0.9964	0.9988	(89)	
MIT 2	18.7509	18.9016	19.1705	19.5284	19.8076	19.9460	19.9700	19.9686	19.8805	19.5066	19.0675	18.7312	(90)	
Living area fraction									fLA = Living area / (4) =			0.1886	(91)	
MIT	18.9274	19.0778	19.3468	19.7048	19.9888	20.1336	20.1619	20.1590	20.0621	19.6816	19.2423	18.9065	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9274	19.0778	19.3468	19.7048	19.9888	20.1336	20.1619	20.1590	20.0621	19.6816	19.2423	18.9065	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9977	0.9949	0.9852	0.9486	0.8471	0.6543	0.4614	0.5248	0.8179	0.9729	0.9953	0.9983	(94)	
Ext temp.	377.7073	437.5087	504.2267	561.2103	545.3698	416.0979	279.5724	292.0088	404.3970	407.3187	367.3717	356.8739	(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	1190.4902	1151.4138	1041.1086	866.8987	663.7779	439.2493	282.7344	297.8974	474.8781	727.2712	976.0893	1186.9183	(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	604.7105	479.7442	399.4401	220.0957	88.0956	0.0000	0.0000	0.0000	0.0000	238.0447	438.2767	617.5530	(98)	
												3085.9606	(98)	
												44.0852	(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	746.1564	587.3997	602.2854	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8754	0.9320	0.9063	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	653.2181	547.4612	545.8496	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	827.0912	790.3815	733.9324	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	125.1886	180.7327	139.9336	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling													445.8549	(104)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.2972	45.1832	34.9834	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												111.4637 (107)
Space cooling per m2												1.5923 (108)
Energy for space heating												44.0852 (99)
Energy for space cooling												1.5923 (108)
Total												45.6775 (109)
Target Fabric Energy Efficiency (TFEE)												52.5 (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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												4.6200
Infiltration rate												0.2310 (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) =	0.1964 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2307	0.2160	0.2160	0.1964	0.2013	0.1914	0.1914	0.1865	0.1865	0.2013	0.1964	0.2013 (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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3143		(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss							(33) + (36) = 51.3237 (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	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
RHI water heating demand												1542 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Pumps, fans	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Total internal gains	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159 (73)

6. Solar gains

[Jan]												
			Area	Solar flux		g		FF		Access		Gains
			m2	Table 6a	Table 6b	Specific data	Specific data	Specific data	Specific data	factor		W
				W/m2		or Table 6b	or Table 6c	or Table 6c	or Table 6c	Table 6d		
North			0.6500	13.4684		0.4500		0.0000		0.7700		3.0334 (74)
East			6.3500	25.1733		0.4500		0.0000		0.7700		55.3881 (76)
West			4.2000	25.1733		0.4500		0.0000		0.7700		36.6346 (80)
Solar gains	95.0561	158.1267	264.6816	386.9238	446.0590	505.3598	462.2031	414.2471	322.0154	202.3481	118.1090	74.0149 (83)
Total gains	602.6073	661.5745	748.6097	840.6870	869.0793	900.7810	841.4641	801.2764	726.3796	637.0771	586.5524	567.8309 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
util living area	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
	0.9864	0.9777	0.9456	0.8520	0.6839	0.4510	0.3150	0.3207	0.5981	0.8795	0.9707	0.9891 (86)
MIT	20.1384	20.2515	20.5050	20.7849	20.9446	20.9943	20.9993	20.9992	20.9783	20.7917	20.4275	20.1054 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9818	0.9705	0.9283	0.8098	0.6103	0.3614	0.2161	0.2169	0.4972	0.8318	0.9591	0.9853 (89)
MIT 2	19.2069	19.3172	19.5598	19.8096	19.9313	19.9587	19.9603	19.9603	19.9525	19.8231	19.4905	19.1747 (90)
Living area fraction	19.3825	19.4934	19.7380	19.9935	20.1224	20.1540	20.1562	20.1562	20.1459	20.0058	19.6672	19.3502 (92)
MIT												0.1886 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.2325	19.3434	19.5880	19.8435	19.9724	20.0040	20.0062	20.0062	19.9959	19.8558	19.5172	19.2002 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9775	0.9649	0.9207	0.8044	0.6112	0.3652	0.2205	0.2215	0.5008	0.8261	0.9527	0.9816 (94)
Ext temp.	589.0750	638.3414	689.2488	676.2500	531.1787	328.9963	185.5499	177.5022	363.8003	526.2906	558.8186	557.3975 (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	1097.2483	1073.9730	964.8872	784.2316	553.1381	330.3186	185.6200	177.5708	369.9151	624.2424	878.6988	1086.5980 (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	378.0810	292.7445	205.0750	77.7467	16.3378	0.0000	0.0000	0.0000	0.0000	72.8761	230.3137	393.7252 (98)
RHI space heating demand												1666.9000 (98)
												1667 (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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.6200			
Infiltration rate														0.2310 (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) =				0.1964 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
	0.2503	0.2454	0.2405	0.2160	0.2111	0.1865	0.1865	0.1816	0.1964	0.2111	0.2209	0.2307 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5003	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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1839	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.5076	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4891 (39)
HLP	Jan 1.1501	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum(45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North				0.6500	10.6334	0.4500	0.0000	0.7700			2.3949 (74)	
East				6.3500	19.6403	0.4500	0.0000	0.7700			43.2140 (76)	
West				4.2000	19.6403	0.4500	0.0000	0.7700			28.5825 (80)	
Solar gains	74.1914	145.0259	239.0767	349.8287	430.2467	441.2225	419.7301	359.4384	278.3616	172.1027	92.4762	61.0384 (83)
Total gains	581.7425	648.4737	723.0049	803.5919	853.2671	836.6437	798.9910	746.4676	682.7258	606.8318	560.9195	554.8544 (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	60.7349	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0490	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9917	0.9846	0.9641	0.9036	0.7757	0.5941	0.4392	0.4886	0.7385	0.9368	0.9845	0.9934 (86)
MIT	19.9750	20.1221	20.3723	20.6691	20.8843	20.9759	20.9956	20.9927	20.9316	20.6413	20.2434	19.9303 (87)
Th 2	19.9601	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9891	0.9798	0.9528	0.8743	0.7165	0.5067	0.3376	0.3820	0.6539	0.9106	0.9787	0.9913 (89)
MIT 2	19.0448	19.1900	19.4334	19.7098	19.8890	19.9503	19.9593	19.9585	19.9267	19.6922	19.3111	19.0008 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.2202	19.3658	19.6105	19.8907	20.0766	20.1437	20.1548	20.1535	20.1162	19.8712	19.4869	19.1761 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0702	19.2158	19.4605	19.7407	19.9266	19.9937	20.0048	20.0035	19.9662	19.7212	19.3369	19.0261 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9860	0.9753	0.9459	0.8671	0.7144	0.5096	0.3420	0.3865	0.6545	0.9031	0.9741	0.9887 (94)
Useful gains	573.5942	632.4243	683.9038	696.7712	609.6028	426.3770	273.2292	288.5331	446.8162	548.0336	546.3721	548.5840 (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	1189.1159	1152.2417	1043.1563	872.5395	662.1414	434.1265	274.0406	290.0360	472.1532	734.1380	984.9194	1193.3132 (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	457.9481	349.3172	267.2839	126.5532	39.0887	0.0000	0.0000	0.0000	0.0000	138.4617	315.7541	479.6785 (98)
Space heating												2174.0854 (98)
Space heating per m2										(98) / (4) =		31.0584 (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													2402.3043 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	457.9481	349.3172	267.2839	126.5532	39.0887	0.0000	0.0000	0.0000	0.0000	138.4617	315.7541	479.6785	(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)	506.0200	385.9859	295.3413	139.8377	43.1920	0.0000	0.0000	0.0000	0.0000	152.9963	348.8995	530.0315	(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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater	89.6613	89.5721	89.3588	88.8753	88.0565	87.3000	87.3000	87.3000	87.3000	88.9175	89.4876	87.3000	(216)
(217)m	89.6613	89.5721	89.3588	88.8753	88.0565	87.3000	87.3000	87.3000	87.3000	88.9175	89.4876	89.7073	(217)
Fuel for water heating, kWh/month	174.9882	153.6260	159.9408	141.6729	138.3081	122.0263	114.7023	129.3075	130.1650	146.9690	157.5143	169.8639	(219)
Water heating fuel used												1739.0842	(219)
Annual totals kWh/year													
Space heating fuel - main system												2402.3043	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												47.3439	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												122.3439	(231)
Electricity for lighting (calculated in Appendix L)												324.0744	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =											-537.4497	-537.4497	(233)
Total delivered energy for all uses												4050.3571	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2402.3043	3.4800	83.6002 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1739.0842	3.4800	60.5201 (247)
Mechanical ventilation fans	47.3439	13.1900	6.2447 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	324.0744	13.1900	42.7454 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-537.4497	13.1900	-70.8896 (252)
Total energy cost			252.1133 (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] = 0.9208 (257)
SAP value	87.1554
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	2402.3043	0.2160	518.8977 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1739.0842	0.2160	375.6422 (264)
Space and water heating			894.5399 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			847.2946 (272)
CO2 emissions per m2			12.1000 (273)
EI value			90.1272
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8857 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8857 = 0.2439$, 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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												4.6200
Infiltration rate												0.2310 (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) =	0.1964 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2307	0.2160	0.2160	0.1964	0.2013	0.1914	0.1914	0.1865	0.1865	0.2013	0.1964	0.2013 (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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (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	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum (45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month												
Solar input	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
								Total per year (kWh/year) =	Sum (64)m =			1542.3261 (64)
Heat gains from water heating, kWh/month												
	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (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)												
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)												
	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				0.6500	13.4684	0.4500	0.0000			0.7700			3.0334 (74)
East				6.3500	25.1733	0.4500	0.0000			0.7700			55.3881 (76)
West				4.2000	25.1733	0.4500	0.0000			0.7700			36.6346 (80)

Solar gains	95.0561	158.1267	264.6816	386.9238	446.0590	505.3598	462.2031	414.2471	322.0154	202.3481	118.1090	74.0149	(83)
Total gains	602.6073	661.5745	748.6097	840.6870	869.0793	900.7810	841.4641	801.2764	726.3796	637.0771	586.5524	567.8309	(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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9864	0.9777	0.9456	0.8520	0.6839	0.4510	0.3150	0.3207	0.5981	0.8795	0.9707	0.9891 (86)
MIT	20.1384	20.2515	20.5050	20.7849	20.9446	20.9943	20.9993	20.9992	20.9783	20.7917	20.4275	20.1054 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9818	0.9705	0.9283	0.8098	0.6103	0.3614	0.2161	0.2169	0.4972	0.8318	0.9591	0.9853 (89)
MIT 2	19.2069	19.3172	19.5598	19.8096	19.9313	19.9587	19.9603	19.9603	19.9525	19.8231	19.4905	19.1747 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.3825	19.4934	19.7380	19.9935	20.1224	20.1540	20.1562	20.1562	20.1459	20.0058	19.6672	19.3502 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2325	19.3434	19.5880	19.8435	19.9724	20.0040	20.0062	20.0062	19.9959	19.8558	19.5172	19.2002 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9775	0.9649	0.9207	0.8044	0.6112	0.3652	0.2205	0.2215	0.5008	0.8261	0.9527	0.9816 (94)
Useful gains	589.0750	638.3414	689.2488	676.2500	531.1787	328.9963	185.5499	177.5022	363.8003	526.2906	558.8186	557.3975 (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	1097.2483	1073.9730	964.8872	784.2316	553.1381	330.3186	185.6200	177.5708	369.9151	624.2424	878.6988	1086.5980 (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	378.0810	292.7445	205.0750	77.7467	16.3378	0.0000	0.0000	0.0000	0.0000	72.8761	230.3137	393.7252 (98)
Space heating												1666.9000 (98)
Space heating per m2										(98) / (4) =		23.8129 (99)

FULL SAP CALCULATION PRINTOUT

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 1841.8785 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	378.0810	292.7445	205.0750	77.7467	16.3378	0.0000	0.0000	0.0000	0.0000	72.8761	230.3137	393.7252 (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)	417.7690	323.4746	226.6022	85.9080	18.0528	0.0000	0.0000	0.0000	0.0000	80.5261	254.4903	435.0554 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
Efficiency of water heater (217)m	89.5375	89.4516	89.1578	88.4945	87.6666	87.3000	87.3000	87.3000	87.3000	88.4193	89.2578	87.3000 (216)
Fuel for water heating, kWh/month	175.2303	153.8331	160.3013	142.2824	138.9231	122.0263	114.7023	129.3075	130.1650	147.7970	157.9198	170.0980 (219)
Water heating fuel used												1742.5863 (219)
Annual totals kWh/year												
Space heating fuel - main system												1841.8785 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)
 mechanical ventilation fans (SFP = 0.2196) 47.3439 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 122.3439 (231)
 Electricity for lighting (calculated in Appendix L) 324.0744 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV Unit 0 (0.80 * 0.74 * 1030 * 1.00) = -609.7952 -609.7952 (233)
 Total delivered energy for all uses 3421.0878 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1841.8785	10.2300	188.4242 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1742.5863	10.2300	178.2666 (247)
Mechanical ventilation fans	47.3439	36.7200	17.3847 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	324.0744	36.7200	119.0001 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-609.7952	36.7200	-223.9168 (252)
Total energy cost			409.6987 (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	1841.8785	0.2160	397.8458 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1742.5863	0.2160	376.3986 (264)
Space and water heating			774.2444 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			689.4518 (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	1841.8785	1.2200	2247.0917 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1742.5863	1.2200	2125.9552 (264)
Space and water heating			4373.0470 (265)
Pumps and fans	122.3439	3.0700	375.5957 (267)
Energy for lighting	324.0744	3.0700	994.9084 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			3871.4799 (272)
Primary energy kWh/m2/year			55.3069 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 78	-179 kg (25.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£78 2.55 kg/m²	B 88	A 92
Total Savings	£78 2.55 kg/m²		
Potential energy efficiency rating:		B 88	
Potential environmental impact rating:			A 92

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£164	£182	-£18
Mains gas	£470	£373	£97
Space heating	£336	£336	£0
Water heating	£178	£100	£78
Lighting	£119	£119	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£410	£331	£79
Total cost of uses	£409	£331	£78
Delivered energy	49 kWh/m²	36 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	3 kg/m²
Primary energy	55 kWh/m²	41 kWh/m²	14 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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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															4.6200		
Infiltration rate															0.2310 (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) =					0.1964 (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																	
	0.2503	0.2454	0.2405	0.2160	0.2111	0.1865	0.1865	0.1816	0.1964	0.2111	0.2209	0.2307 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5003	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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1839	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.5076	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4891 (39)
HLP	Jan 1.1501	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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												1.3167 (H8)
Utilisation factor												0.5321 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.5455 (H14)
Volume ratio Veff/V												0.8567 (H15)
Solar storage volume factor												0.9691 (H16)
Solar input												-822.2846 (H17)
Solar input	-23.8446	-39.7898	-67.7666	-90.8206	-112.2012	-110.3117	-108.8538	-95.1061	-74.4872	-50.8660	-28.2831	-19.9539 (63)
Solar input (sum of months) = Sum (63)m =												-822.2846 (63)
Output from w/h	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263 (64)
Total per year (kWh/year) = Sum (64)m =												732.5429 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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)
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392	(72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				0.6500	10.6334		0.4500		0.0000		0.7700		2.3949 (74)
East				6.3500	19.6403		0.4500		0.0000		0.7700		43.2140 (76)
West				4.2000	19.6403		0.4500		0.0000		0.7700		28.5825 (80)
Solar gains	74.1914	145.0259	239.0767	349.8287	430.2467	441.2225	419.7301	359.4384	278.3616	172.1027	92.4762	61.0384	(83)
Total gains	581.7425	648.4737	723.0049	803.5919	853.2671	836.6437	798.9910	746.4676	682.7258	606.8318	560.9195	554.8544	(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	60.7349	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	
alpha	5.0490	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	
util living area	0.9917	0.9846	0.9641	0.9036	0.7757	0.5941	0.4392	0.4886	0.7385	0.9368	0.9845	0.9934	(86)
MIT	19.9750	20.1221	20.3723	20.6691	20.8843	20.9759	20.9956	20.9927	20.9316	20.6413	20.2434	19.9303	(87)
Th 2	19.9601	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	(88)
util rest of house	0.9891	0.9798	0.9528	0.8743	0.7165	0.5067	0.3376	0.3820	0.6539	0.9106	0.9787	0.9913	(89)
MIT 2	19.0448	19.1900	19.4334	19.7098	19.8890	19.9503	19.9593	19.9585	19.9267	19.6922	19.3111	19.0008	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	19.2202	19.3658	19.6105	19.8907	20.0766	20.1437	20.1548	20.1535	20.1162	19.8712	19.4869	19.1761	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0702	19.2158	19.4605	19.7407	19.9266	19.9937	20.0048	20.0035	19.9662	19.7212	19.3369	19.0261	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9753	0.9459	0.8671	0.7144	0.5096	0.3420	0.3865	0.6545	0.9031	0.9741	0.9887	(94)
Useful gains	573.5942	632.4243	683.9038	696.7712	609.6028	426.3770	273.2292	288.5331	446.8162	548.0336	546.3721	548.5840	(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	1189.1159	1152.2417	1043.1563	872.5395	662.1414	434.1265	274.0406	290.0360	472.1532	734.1380	984.9194	1193.3132	(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	457.9481	349.3172	267.2839	126.5532	39.0887	0.0000	0.0000	0.0000	0.0000	138.4617	315.7541	479.6785	(98)
Space heating												2174.0854	(98)
Space heating per m2											(98) / (4) =	31.0584	(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													2402.3043 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	457.9481	349.3172	267.2839	126.5532	39.0887	0.0000	0.0000	0.0000	0.0000	138.4617	315.7541	479.6785	(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)	506.0200	385.9859	295.3413	139.8377	43.1920	0.0000	0.0000	0.0000	0.0000	152.9963	348.8995	530.0315	(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	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263	(64)
Efficiency of water heater	89.7593	89.7801	89.7778	89.7855	89.8513	87.3000	87.3000	87.3000	87.3000	89.3030	89.6359	87.3000	(216)
(217)m	89.7593	89.7801	89.7778	89.7855	89.8513	87.3000	87.3000	87.3000	87.3000	89.3030	89.6359	87.3000	(217)
Fuel for water heating, kWh/month	148.2322	108.9510	83.7117	39.0838	10.6710	0.0000	0.0000	20.3658	44.8418	89.3756	125.7003	147.4878	(219)
Water heating fuel used												818.4211	(219)
Annual totals kWh/year													
Space heating fuel - main system												2402.3043	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													47.3439 (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													172.3439 (231)
Electricity for lighting (calculated in Appendix L)													324.0744 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =									-537.4497			-537.4497	(233)
Total delivered energy for all uses												3179.6939	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2402.3043	3.4800	83.6002	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	818.4211	3.4800	28.4811	(247)
Mechanical ventilation fans	47.3439	13.1900	6.2447	(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	324.0744	13.1900	42.7454	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			226.6692	(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] =	0.8278	(257)
SAP value		88.4517	
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	2402.3043	0.2160	518.8977 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	818.4211	0.2160	176.7789 (264)
Space and water heating			695.6767 (265)
Pumps and fans	172.3439	0.5190	89.4465 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			674.3814 (272)
CO2 emissions per m2			9.6300 (273)
EI value			92.1420
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												4.6200
Infiltration rate												0.2310 (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) =	0.1964 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2307	0.2160	0.2160	0.1964	0.2013	0.1914	0.1914	0.1865	0.1865	0.2013	0.1964	0.2013 (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)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	Jan 1.1498	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

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 content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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												1.4709 (H8)
Utilisation factor												0.4933 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.5455 (H14)
Volume ratio Veff/V												0.8567 (H15)
Solar storage volume factor												0.9691 (H16)
Solar input												-851.6522 (H17)
Solar input	-27.7905	-39.5212	-68.5795	-92.2510	-107.2019	-116.6045	-110.5589	-100.8190	-78.9108	-54.5403	-32.8698	-22.0049 (63)
Solar input (sum of months) = Sum (63)m =												-851.6522 (63)
Output from w/h	129.1063	98.0849	74.3417	33.6612	14.5874	0.0000	0.0000	12.0665	34.7233	76.1408	108.0859	130.3753 (64)
Total per year (kWh/year) = Sum (64)m =												711.1732 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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)
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392	(72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North				0.6500	13.4684	0.4500	0.0000			0.7700	3.0334 (74)	
East				6.3500	25.1733	0.4500	0.0000			0.7700	55.3881 (76)	
West				4.2000	25.1733	0.4500	0.0000			0.7700	36.6346 (80)	
Solar gains	95.0561	158.1267	264.6816	386.9238	446.0590	505.3598	462.2031	414.2471	322.0154	202.3481	118.1090	74.0149 (83)
Total gains	602.6073	661.5745	748.6097	840.6870	869.0793	900.7810	841.4641	801.2764	726.3796	637.0771	586.5524	567.8309 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	
util living area	0.9864	0.9777	0.9456	0.8520	0.6839	0.4510	0.3150	0.3207	0.5981	0.8795	0.9707	0.9891	(86)
MIT	20.1384	20.2515	20.5050	20.7849	20.9446	20.9943	20.9993	20.9992	20.9783	20.7917	20.4275	20.1054	(87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	(88)
util rest of house	0.9818	0.9705	0.9283	0.8098	0.6103	0.3614	0.2161	0.2169	0.4972	0.8318	0.9591	0.9853	(89)
MIT 2	19.2069	19.3172	19.5598	19.8096	19.9313	19.9587	19.9603	19.9603	19.9525	19.8231	19.4905	19.1747	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	19.3825	19.4934	19.7380	19.9935	20.1224	20.1540	20.1562	20.1562	20.1459	20.0058	19.6672	19.3502	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2325	19.3434	19.5880	19.8435	19.9724	20.0040	20.0062	20.0062	19.9959	19.8558	19.5172	19.2002	(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	0.9775	0.9649	0.9207	0.8044	0.6112	0.3652	0.2205	0.2215	0.5008	0.8261	0.9527	0.9816	(94)
Useful gains	589.0750	638.3414	689.2488	676.2500	531.1787	328.9963	185.5499	177.5022	363.8003	526.2906	558.8186	557.3975	(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	1097.2483	1073.9730	964.8872	784.2316	553.1381	330.3186	185.6200	177.5708	369.9151	624.2424	878.6988	1086.5980	(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	378.0810	292.7445	205.0750	77.7467	16.3378	0.0000	0.0000	0.0000	0.0000	72.8761	230.3137	393.7252	(98)
Space heating												1666.9000	(98)
Space heating per m2												23.8129	(99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1841.8785 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	378.0810	292.7445	205.0750	77.7467	16.3378	0.0000	0.0000	0.0000	0.0000	72.8761	230.3137	393.7252	(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)	417.7690	323.4746	226.6022	85.9080	18.0528	0.0000	0.0000	0.0000	0.0000	80.5261	254.4903	435.0554	(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	129.1063	98.0849	74.3417	33.6612	14.5874	0.0000	0.0000	12.0665	34.7233	76.1408	108.0859	130.3753	(64)
Efficiency of water heater	89.6634	89.6751	89.6259	89.5087	88.9618	87.3000	87.3000	87.3000	87.3000	88.8362	89.4527	87.3000	(216)
(217)m	89.6634	89.6751	89.6259	89.5087	88.9618	87.3000	87.3000	87.3000	87.3000	88.8362	89.4527	89.6822	(217)
Fuel for water heating, kWh/month	143.9900	109.3781	82.9466	37.6066	16.3974	0.0000	0.0000	13.8219	39.7746	85.7092	120.8303	145.3747	(219)
Water heating fuel used												795.8294	(219)
Annual totals kWh/year													
Space heating fuel - main system												1841.8785	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													47.3439 (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													172.3439 (231)
Electricity for lighting (calculated in Appendix L)													324.0744 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.74 * 1030 * 1.00) =										-609.7952		-609.7952	(233)
Total delivered energy for all uses												2524.3310	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1841.8785	10.2300	188.4242	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	795.8294	10.2300	81.4133	(247)
Mechanical ventilation fans	47.3439	36.7200	17.3847	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	324.0744	36.7200	119.0001	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			331.2055	(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	1841.8785	0.2160	397.8458	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	795.8294	0.2160	171.8991	(264)
Space and water heating			569.7449	(265)
Pumps and fans	172.3439	0.5190	89.4465	(267)

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 for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			510.9023 (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	1841.8785	1.2200	2247.0917 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	795.8294	1.2200	970.9118 (264)
Space and water heating			3218.0036 (265)
Pumps and fans	172.3439	3.0700	529.0957 (267)
Energy for lighting	324.0744	3.0700	994.9084 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			2869.9365 (272)
Primary energy kWh/m2/year			40.9991 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	251.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	233.31 (P1)
Transmission heat loss coefficient	51.32 (37)
Summer heat loss coefficient	284.63 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.6500	87.1704	0.4500	0.0000	0.9000	22.9476
East	6.3500	125.2818	0.4500	0.0000	0.9000	322.1934
West	4.2000	125.2818	0.4500	0.0000	0.9000	213.1043
total:						558.2453

	Jun	Jul	Aug	
Solar gains	601	558	489	(P4)
Internal gains	392	376	384	
Total summer gains	993	935	874	(P5)
Summer gain/loss ratio	3.49	3.28	3.07	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 251.5)	0.24	0.24	0.24	
Threshold temperature	19.13	20.82	20.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 86	Issued on Date	10/08/2023
Assessment Reference	86 Hamble	Prop Type Ref	21809
Property	4 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	87 B	DER	14.21
Environmental	90 B	TER	19.10
CO ₂ Emissions (t/year)	0.69	% DER<TER	25.60
General Requirements Compliance	Pass	DFEE	47.25
		TFEE	52.53
		% DFEE<TFEE	10.05
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.10	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.21	kgCO ₂ /m ²	Pass
	-4.89 (-25.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.53	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.25	kWh/m ² /yr	
	-5.2 (-9.9%)	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	4.62 (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)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

0.65 m², No overhang

Windows facing East

6.35 m², No overhang

Windows facing West

4.20 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

4.62 (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

0.74

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 86				Issued on Date	10/08/2023
Assessment Reference	86 Hamble			Prop Type Ref	21809	
Property	4 Hickory Way, Hedge End, Southampton, SO30 0AW					
SAP Rating		87 B	DER	14.21	TER	19.10
Environmental		90 B	% DER<TER	25.60		
CO ₂ Emissions (t/year)		0.69	DFEE	47.25	TFEE	52.53
General Requirements Compliance		Pass	% DFEE<TFEE	10.05		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk				Assessor ID	Y128-0001
Client						

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

Orientation	West
Property Tenure	Owner-occupied
Transaction Type	Marketed sale
Terrain Type	Suburban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	1.00 m	35.00 m ²	2.45 m
	1st Storey:	1.00 m	35.00 m ²	2.60 m

7.0 Living Area	13.20	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	251.47	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.27	150.00	84.84	71.54

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
party	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	41.41

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
stud	Plasterboard on timber frame		9.00	124.80

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cd	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	35.00	35.00

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
internal	Other	9.00	35.00

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	35.00

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	35.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
entrance	Manufacturer	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft	0.05		0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
entrance	Solid Door	[1] external	West							2.10	
front	Window	[1] external	West	None	0.00					4.20	
rear	Window	[1] external	East	None	0.00					6.35	
side	Window	[1] external	North	None	0.00					0.65	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.70	0.300	No
Independently assessed	E3 Sill	6.30	0.015	No
Independently assessed	E4 Jamb	22.30	0.011	No
Independently assessed	E5 Ground floor (normal)	16.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	16.80	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.60	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.20	0.063	No
Independently assessed	E16 Corner (normal)	10.20	0.067	No
Independently assessed	E18 Party wall between dwellings	10.20	0.042	No
Independently assessed	P1 Party wall - Ground floor	8.20	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.20	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.20	0.091	No

Y-value	0.045	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.01	m ³ /(h.m ²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.62	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows half open

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

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

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

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

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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

32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.74	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£78	B 88	