

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 72	Issued on Date	20/12/2023
Assessment Reference	72 Hedge	Prop Type Ref	21809
Property	6 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	13.82
Environmental	90 B	TER	18.01
CO ₂ Emissions (t/year)	0.83	% DER<TER	23.27
General Requirements Compliance	Pass	DFEE	45.75
		TFEE	51.40
		% DFEE<TFEE	10.99
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk		Assessor ID
Client	AU36-0001		

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 86 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) 18.01 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.82 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.8 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: 4.42 (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: 7.50 m², No overhang
Windows facing West: 4.35 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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (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														4.4200			
Infiltration rate														0.2210 (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) =				0.1879 (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																	
	0.2395	0.2348	0.2301	0.2066	0.2019	0.1785	0.1785	0.1738	0.1879	0.2019	0.2113	0.2207 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:														0.5000 (23a)			
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	Jan 1.0892	Feb 1.0892	Mar 1.0892	Apr 1.0892	May 1.0892	Jun 1.0892	Jul 1.0892	Aug 1.0892	Sep 1.0892	Oct 1.0892	Nov 1.0892	Dec 1.0892 (40)
HLP (average)												1.0892 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan 104.5983	Feb 100.7947	Mar 96.9911	Apr 93.1875	May 89.3840	Jun 85.5804	Jul 85.5804	Aug 89.3840	Sep 93.1875	Oct 96.9911	Nov 100.7947	Dec 104.5983 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (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	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188 (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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	391.5794	389.3268	375.0744	352.1455	328.8407	306.4985	292.0836	298.3221	310.2019	333.3480	359.8801	379.7989 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				0.6500	10.6334	0.4500	0.0000			0.7700			2.3949 (74)
East				7.5000	19.6403	0.4500	0.0000			0.7700			51.0401 (76)
West				4.3500	19.6403	0.4500	0.0000			0.7700			29.6033 (80)

Solar gains	83.0383	162.3324	267.5781	391.3963	481.1893	493.3713	469.3779	402.0851	311.5099	192.6384	103.5073	68.3137	(83)
Total gains	474.6177	551.6592	642.6525	743.5418	810.0300	799.8698	761.4615	700.4072	621.7119	525.9864	463.3873	448.1126	(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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9982	0.9959	0.9874	0.9545	0.8616	0.6946	0.5284	0.5921	0.8486	0.9783	0.9963	0.9987 (86)
MIT	19.7410	19.8936	20.1654	20.5123	20.8017	20.9507	20.9898	20.9824	20.8642	20.4703	20.0301	19.6998 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9976	0.9945	0.9831	0.9385	0.8157	0.6072	0.4154	0.4751	0.7808	0.9680	0.9949	0.9982 (89)
MIT 2	18.8576	19.0095	19.2791	19.6154	19.8755	19.9866	20.0069	20.0044	19.9322	19.5808	19.1462	18.8164 (90)
Living area fraction	19.0069	19.1589	19.4289	19.7669	20.0320	20.1495	20.1730	20.1697	20.0897	19.7312	19.2956	0.1690 (91)
MIT	19.0069	19.1589	19.4289	19.7669	20.0320	20.1495	20.1730	20.1697	20.0897	19.7312	19.2956	18.9657 (92)
Temperature adjustment	18.8569	19.0089	19.2789	19.6169	19.8820	19.9995	20.0230	20.0197	19.9397	19.5812	19.1456	-0.1500
adjusted MIT	18.8569	19.0089	19.2789	19.6169	19.8820	19.9995	20.0230	20.0197	19.9397	19.5812	19.1456	18.8157 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9926	0.9788	0.9306	0.8088	0.6062	0.4169	0.4764	0.7751	0.9619	0.9931	0.9975 (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	1360.4024	1318.5407	1194.2381	1001.5433	764.6421	504.6100	319.8958	338.2746	545.7459	839.3267	1125.7126	1365.9012 (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	660.1965	518.0889	420.5008	222.9252	81.4603	0.0000	0.0000	0.0000	0.0000	248.0497	479.1761	683.6737 (98)
Space heating	3314.0712 (98)											
Space heating per m2	(98) / (4) = 38.6255 (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													3661.9572 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	660.1965	518.0889	420.5008	222.9252	81.4603	0.0000	0.0000	0.0000	0.0000	248.0497	479.1761	683.6737	(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)	729.4989	572.4739	464.6418	246.3262	90.0114	0.0000	0.0000	0.0000	0.0000	274.0880	529.4763	755.4405	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.8281	89.7673	89.6191	89.2623	88.4991	87.3000	87.3000	87.3000	87.3000	89.3147	89.7082	87.3000	(216)
(217)m	89.8281	89.7673	89.6191	89.2623	88.4991	87.3000	87.3000	87.3000	87.3000	89.3147	89.7082	89.8617	(217)
Fuel for water heating, kWh/month	188.4098	165.3347	171.9245	151.9529	148.1579	131.2463	123.2459	139.1132	140.0895	157.6225	169.4146	182.8798	(219)
Water heating fuel used	188.4098	165.3347	171.9245	151.9529	148.1579	131.2463	123.2459	139.1132	140.0895	157.6225	169.4146	1869.3915	(219)
Annual totals kWh/year													
Space heating fuel - main system												3661.9572	(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)												58.0300	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												133.0300	(231)
Electricity for lighting (calculated in Appendix L)												387.0660	(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												5513.9950	(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	3661.9572	0.2160	790.9828	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1869.3915	0.2160	403.7886	(264)
Space and water heating			1194.7713	(265)
Pumps and fans	133.0300	0.5190	69.0426	(267)
Energy for lighting	387.0660	0.5190	200.8872	(268)
Energy saving/generation technologies				
PV Unit	-537.4497	0.5190	-278.9364	(269)
Total CO2, kg/year			1185.7648	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8200	(273)

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

DER		13.8200	ZC1
Total Floor Area	TFA	85.8000	
Assumed number of occupants	N	2.5638	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9634	ZC2
CO2 emissions from cooking, equation (L16)		2.1041	ZC3
Total CO2 emissions		31.8875	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.8875	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3885 (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) =	0.3302 (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	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880 (22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			12.5000	1.3258	16.5720		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	14.5000	80.4400	0.1800	14.4792		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2052		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4920 (36)					
Total fabric heat loss						(33) + (36) =	53.6972 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0825	Feb 41.8364	Mar 41.5953	Apr 40.4625	May 40.2506	Jun 39.2640	Jul 39.2640	Aug 39.0813	Sep 39.6440	Oct 40.2506	Nov 40.6793	Dec 41.1276 (38)
Heat transfer coeff	95.7796	95.5336	95.2924	94.1597	93.9478	92.9612	92.9612	92.7785	93.3412	93.9478	94.3765	94.8247 (39)
Average = Sum(39)m / 12 =												94.1587 (39)
HLP	Jan 1.1163	Feb 1.1134	Mar 1.1106	Apr 1.0974	May 1.0950	Jun 1.0835	Jul 1.0835	Aug 1.0813	Sep 1.0879	Oct 1.0950	Nov 1.1000	Dec 1.1052 (40)
HLP (average)												1.0974 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)												Total = Sum(45)m = 1496.1255 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.4256	45.9555	45.5491	42.2040	43.6108	45.5491	45.9555	49.4256	49.3151	50.9589 (61)
Solar input	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (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	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (64)
	64.3159	56.6157	58.9047	52.0708	50.3266	44.1527	42.0396	47.1173	47.6456	54.4936	58.3248	62.6885 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	86.4461	84.2495	79.1729	72.3205	67.6432	61.3231	56.5048	63.3297	66.1745	73.2441	81.0067	84.2587	(72)
Total internal gains	403.9551	401.7064	386.9505	363.3850	339.4392	316.4581	302.0506	308.9276	321.4518	345.2344	372.2656	392.1785	(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				7.5000	19.6403	0.6300	0.7000	0.7700	45.0174 (76)			
West				4.3500	19.6403	0.6300	0.7000	0.7700	26.1101 (80)			

Solar gains	73.2398	143.1772	236.0039	345.2116	424.4090	435.1535	413.9913	354.6391	274.7518	169.9071	91.2934	60.2527 (83)
Total gains	477.1949	544.8836	622.9544	708.5966	763.8482	751.6116	716.0420	663.5667	596.2035	515.1415	463.5590	452.4313 (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	62.2088	62.3690	62.5268	63.2790	63.4218	64.0949	64.0949	64.2211	63.8339	63.4218	63.1337	62.8352	
alpha	5.1473	5.1579	5.1685	5.2186	5.2281	5.2730	5.2730	5.2814	5.2556	5.2281	5.2089	5.1890	
util living area	0.9986	0.9969	0.9910	0.9665	0.8901	0.7290	0.5581	0.6194	0.8707	0.9830	0.9971	0.9990	(86)
MIT	19.7632	19.9037	20.1573	20.4978	20.7857	20.9479	20.9895	20.9825	20.8617	20.4796	20.0615	19.7407	(87)
Th 2	19.9875	19.9899	19.9922	20.0029	20.0049	20.0144	20.0144	20.0161	20.0107	20.0049	20.0009	19.9966	(88)
util rest of house	0.9981	0.9959	0.9877	0.9535	0.8482	0.6406	0.4399	0.4987	0.8059	0.9743	0.9959	0.9986	(89)
MIT 2	18.3321	18.5390	18.9096	19.4044	19.7907	19.9789	20.0104	20.0087	19.8952	19.3868	18.7779	18.3057	(90)
Living area fraction	18.5740	18.7696	19.1204	19.5891	19.9588	20.1427	20.1759	20.1732	20.0585	19.5715	18.9948	18.5482	(91)
MIT	18.5740	18.7696	19.1204	19.5891	19.9588	20.1427	20.1759	20.1732	20.0585	19.5715	18.9948	18.5482	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5740	18.7696	19.1204	19.5891	19.9588	20.1427	20.1759	20.1732	20.0585	19.5715	18.9948	18.5482	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9971	0.9940	0.9836	0.9466	0.8459	0.6530	0.4599	0.5189	0.8096	0.9689	0.9941	0.9978	(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	1367.1552	1325.0172	1202.6317	1006.4869	775.8979	515.2544	332.4179	350.0751	556.1764	842.8536	1122.5939	1360.5638	(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	663.1575	526.4624	438.8684	241.7448	96.5211	0.0000	0.0000	0.0000	0.0000	255.7317	476.4689	676.3933	(98)
Space heating												3375.3481	(98)
Space heating per m2												39.3397	(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												3613.8630 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	663.1575	526.4624	438.8684	241.7448	96.5211	0.0000	0.0000	0.0000	0.0000	255.7317	476.4689	676.3933 (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)	710.0188	563.6642	469.8805	258.8274	103.3417	0.0000	0.0000	0.0000	0.0000	273.8026	510.1380	724.1898 (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	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (64)
Efficiency of water heater	87.7824	87.5739	87.0972	85.9666	83.7861	80.3000	80.3000	80.3000	80.3000	85.9887	87.2975	80.3000 (216)
(217)m	87.7824	87.5739	87.0972	85.9666	83.7861	80.3000	80.3000	80.3000	80.3000	85.9887	87.2975	87.8664 (217)
Fuel for water heating, kWh/month	234.7568	207.4740	217.4815	195.4322	194.1369	178.4080	170.9285	190.5452	192.6496	204.8573	214.9535	228.9619 (219)
Water heating fuel used	234.7568	207.4740	217.4815	195.4322	194.1369	178.4080	170.9285	190.5452	192.6496	204.8573	214.9535	2430.5853 (219)
Annual totals kWh/year												
Space heating fuel - main system												3613.8630 (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)												387.0660 (232)
Total delivered energy for all uses												6506.5143 (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	3613.8630	0.2160	780.5944 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2430.5853	0.2160	525.0064 (264)
Space and water heating			1305.6008 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Total CO2, kg/m2/year			1545.4131 (272)
Emissions per m2 for space and water heating			15.2168 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3413 (272b)
Emissions per m2 for pumps and fans			0.4537 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2168 * 1.00) + 2.3413 + 0.4537, rounded to 2 d.p.			18.0100 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3595 (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) =	0.3056 (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	0.3896	0.3819	0.3743	0.3361	0.3285	0.2903	0.2903	0.2826	0.3056	0.3285	0.3437	0.3590 (22b)
Effective ac	0.5759	0.5729	0.5701	0.5565	0.5539	0.5421	0.5421	0.5399	0.5467	0.5539	0.5591	0.5644 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1578		(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 20258.2505 (34)
236.1101 (35)
7.5500 (36)
(33) + (36) = 57.7078 (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	41.1718	40.9611	40.7546	39.7847	39.6032	38.7584	38.7584	38.6020	39.0838	39.6032	39.9703	40.3541 (38)
Heat transfer coeff	98.8796	98.6689	98.4624	97.4925	97.3110	96.4663	96.4663	96.3098	96.7917	97.3110	97.6781	98.0619 (39)
Average = Sum(39)m / 12 =												97.4916 (39)
HLP	1.1524	1.1500	1.1476	1.1363	1.1342	1.1243	1.1243	1.1225	1.1281	1.1342	1.1384	1.1429 (40)
HLP (average)												1.1363 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m												1496.1255 (45)

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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	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.8130	357.3571	344.7626	324.0864	302.2449	281.9610	269.2925	273.2901	284.3713	305.1863	329.0866	347.8259	(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				7.5000	19.6403	0.4500	0.0000	0.7700	51.0401 (76)			
West				4.3500	19.6403	0.4500	0.0000	0.7700	29.6033 (80)			
Solar gains	83.0383	162.3324	267.5781	391.3963	481.1893	493.3713	469.3779	402.0851	311.5099	192.6384	103.5073	68.3137 (83)
Total gains	441.8513	519.6895	612.3407	715.4827	783.4342	775.3323	738.6704	675.3752	595.8812	497.8247	432.5939	416.1397 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9105	57.0320	57.1517	57.7203	57.8279	58.3343	58.3343	58.4291	58.1382	57.8279	57.6105	57.3851	
alpha	4.7940	4.8021	4.8101	4.8480	4.8552	4.8890	4.8890	4.8953	4.8759	4.8552	4.8407	4.8257	
util living area	0.9987	0.9969	0.9902	0.9632	0.8831	0.7242	0.5577	0.6247	0.8734	0.9835	0.9973	0.9990	(86)
MIT	19.6153	19.7744	20.0592	20.4369	20.7552	20.9357	20.9856	20.9757	20.8305	20.4001	19.9372	19.5879	(87)
Th 2	19.9582	19.9602	19.9622	19.9713	19.9730	19.9810	19.9810	19.9825	19.9779	19.9730	19.9696	19.9659	(88)
util rest of house	0.9982	0.9958	0.9867	0.9495	0.8403	0.6351	0.4370	0.5014	0.8101	0.9753	0.9962	0.9987	(89)
MIT 2	18.6912	18.8514	19.1360	19.5122	19.8045	19.9504	19.9771	19.9751	19.8788	19.4832	19.0217	18.6700	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.8474	19.0074	19.2920	19.6684	19.9652	20.1169	20.1476	20.1442	20.0396	19.6381	19.1764	18.8251	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8474	19.0074	19.2920	19.6684	19.9652	20.1169	20.1476	20.1442	20.0396	19.6381	19.1764	18.8251	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9945	0.9838	0.9445	0.8399	0.6480	0.4574	0.5221	0.8146	0.9716	0.9951	0.9982	(94)
Ext temp.	440.7826	516.8092	602.3904	675.7510	658.0217	502.4333	337.9044	352.6184	485.4107	483.6894	430.4557	415.3853	(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	1438.4397	1391.9637	1259.5325	1049.8422	804.2942	532.1939	342.2209	360.6044	574.9076	879.5092	1179.6003	1434.1668	(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	742.2569	588.1038	488.9137	269.3457	108.8267	0.0000	0.0000	0.0000	0.0000	294.4899	539.3841	757.9735	(98)
Space heating per m2												3789.2942	(98)
										(98) / (4) =		44.1643	(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	906.7828	713.8503	731.9546	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8691	0.9265	0.8990	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	788.1226	661.4103	657.9969	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	1002.9304	958.1083	885.9465	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	154.6617	220.7433	169.5945	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												544.9995 (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	38.6654	55.1858	42.3986	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												136.2499 (107)
Space cooling per m2												1.5880 (108)
Energy for space heating												44.1643 (99)
Energy for space cooling												1.5880 (108)
Total												45.7523 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.8 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3885 (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) =	0.3302 (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	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880 (22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			12.5000	1.3258	16.5720		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	14.5000	80.4400	0.1800	14.4792		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2052		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4920 (36)					
Total fabric heat loss						(33) + (36) =	53.6972 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0825	Feb 41.8364	Mar 41.5953	Apr 40.4625	May 40.2506	Jun 39.2640	Jul 39.2640	Aug 39.0813	Sep 39.6440	Oct 40.2506	Nov 40.6793	Dec 41.1276 (38)
Heat transfer coeff	95.7796	95.5336	95.2924	94.1597	93.9478	92.9612	92.9612	92.7785	93.3412	93.9478	94.3765	94.8247 (39)
Average = Sum(39)m / 12 =												94.1587 (39)
HLP	Jan 1.1163	Feb 1.1134	Mar 1.1106	Apr 1.0974	May 1.0950	Jun 1.0835	Jul 1.0835	Aug 1.0813	Sep 1.0879	Oct 1.0950	Nov 1.1000	Dec 1.1052 (40)
HLP (average)												1.0974 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)											Total = Sum(45)m =	1496.1255 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.8130	357.3571	344.7626	324.0864	302.2449	281.9610	269.2925	273.2901	284.3713	305.1863	329.0866	347.8259	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	0.6500	10.6334	0.6300	0.7000	0.7700	2.1123	(74)
East	7.5000	19.6403	0.6300	0.7000	0.7700	45.0174	(76)
West	4.3500	19.6403	0.6300	0.7000	0.7700	26.1101	(80)

Solar gains	73.2398	143.1772	236.0039	345.2116	424.4090	435.1535	413.9913	354.6391	274.7518	169.9071	91.2934	60.2527	(83)
Total gains	432.0528	500.5343	580.7665	669.2980	726.6539	717.1145	683.2838	627.9292	559.1231	475.0934	420.3800	408.0786	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2088	62.3690	62.5268	63.2790	63.4218	64.0949	64.0949	64.2211	63.8339	63.4218	63.1337	62.8352	
alpha	5.1473	5.1579	5.1685	5.2186	5.2281	5.2730	5.2730	5.2814	5.2556	5.2281	5.2089	5.1890	
util living area	0.9991	0.9979	0.9934	0.9733	0.9059	0.7531	0.5819	0.6486	0.8932	0.9880	0.9982	0.9994	(86)
MIT	19.7138	19.8555	20.1127	20.4608	20.7618	20.9392	20.9873	20.9784	20.8399	20.4387	20.0144	19.6920	(87)
Th 2	19.9875	19.9899	19.9922	20.0029	20.0049	20.0144	20.0144	20.0161	20.0107	20.0049	20.0009	19.9966	(88)
util rest of house	0.9988	0.9972	0.9909	0.9626	0.8677	0.6656	0.4601	0.5250	0.8345	0.9816	0.9974	0.9991	(89)
MIT 2	18.8080	18.9514	19.2092	19.5595	19.8394	19.9855	20.0110	20.0097	19.9165	19.5436	19.1191	18.7935	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.9611	19.1042	19.3618	19.7118	19.9953	20.1467	20.1760	20.1734	20.0725	19.6949	19.2704	18.9453	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9611	19.1042	19.3618	19.7118	19.9953	20.1467	20.1760	20.1734	20.0725	19.6949	19.2704	18.9453	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	431.3590	498.6876	574.2648	641.5615	630.2311	486.5025	328.5671	342.8231	469.0519	465.0279	418.9585	407.5936	(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	1404.2319	1356.9745	1225.6370	1018.0396	779.3274	515.6270	332.4314	350.0875	557.4829	854.4446	1148.5986	1398.2212	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating kWh	723.8175	576.7688	484.6209	271.0642	110.9277	0.0000	0.0000	0.0000	0.0000	289.7260	525.3409	737.0270	(98)
Space heating												3719.2929	(98)
Space heating per m2												43.3484	(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	873.8351	687.9127	705.1165	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8676	0.9281	0.9010	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	758.0983	638.4284	635.2855	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	934.8836	893.3707	830.4901	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	127.2855	189.6771	145.2322	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												462.1948	(104)

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Calculation Type: New Build (As Built)



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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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.8214	47.4193	36.3081	0.0000	0.0000	0.0000 (107)
Space cooling											115.5487 (107)
Space cooling per m2											1.3467 (108)
Energy for space heating											43.3484 (99)
Energy for space cooling											1.3467 (108)
Total											44.6951 (109)
Target Fabric Energy Efficiency (TFEE)											51.4 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (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					4.4200
Infiltration rate					0.2210 (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) =		0.1879 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.2207	0.2066	0.2066	0.1879	0.1925	0.1832	0.1832	0.1785	0.1785	0.1925	0.1879	0.1925 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	1496.1255 (45)
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	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
RHI water heating demand	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)
Heat gains from water heating, kWh/month												
Total per year (kWh/year) = Sum(64)m =												1661.5070 (64)
												1662 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734 (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					7.5000	25.1733	0.4500	0.0000	0.7700	65.4190 (76)		
West					4.3500	25.1733	0.4500	0.0000	0.7700	37.9430 (80)		
Solar gains	106.3954	176.9961	296.2177	432.8548	498.8167	565.0254	516.8159	463.3458	360.3332	226.4870	132.2015	82.8413 (83)
Total gains	687.4586	753.3122	849.8516	951.4532	981.5710	1015.8256	949.0918	904.3547	821.6519	723.0582	667.8440	648.0147 (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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9870	0.9789	0.9490	0.8608	0.6976	0.4635	0.3242	0.3298	0.6111	0.8863	0.9723	0.9896 (86)
MIT	20.1189	20.2305	20.4837	20.7688	20.9380	20.9933	20.9991	20.9991	20.9754	20.7788	20.4098	20.0866 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9829	0.9724	0.9335	0.8223	0.6279	0.3763	0.2273	0.2282	0.5143	0.8428	0.9619	0.9862 (89)
MIT 2	19.2325	19.3417	19.5853	19.8432	19.9756	20.0075	20.0095	20.0095	20.0001	19.8593	19.5187	19.2009 (90)
Living area fraction	19.3823	19.4919	19.7371	19.9996	20.1382	20.1741	20.1768	20.1768	fLA = Living area / (4) =	20.1650	20.0147	19.6693 (91)
MIT	19.3823	19.4919	19.7371	19.9996	20.1382	20.1741	20.1768	20.1768	20.1650	20.0147	19.6693	19.3506 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2323	19.3419	19.5871	19.8496	19.9882	20.0241	20.0268	20.0268	20.0150	19.8647	19.5193	19.2006 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	672.7458	728.2716	786.4784	775.5998	614.7212	383.5580	217.3438	208.0003	423.0270	603.9086	637.9719	636.6497 (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	1273.9967	1246.8540	1120.2481	911.1400	643.7329	385.4182	217.4474	208.1016	431.2881	725.6446	1020.4556	1261.6864 (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	447.3307	348.4874	248.3246	97.5889	21.5847	0.0000	0.0000	0.0000	0.0000	90.5716	275.3883	465.0274 (98)
Space heating												1994.3036 (98)
RHI space heating demand												1994 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (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															4.4200		
Infiltration rate															0.2210 (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) =					0.1879 (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																	
	0.2395	0.2348	0.2301	0.2066	0.2019	0.1785	0.1785	0.1738	0.1879	0.2019	0.2113	0.2207 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (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	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790	(72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734	(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				7.5000	19.6403	0.4500	0.0000	0.7700		51.0401 (76)		
West				4.3500	19.6403	0.4500	0.0000	0.7700		29.6033 (80)		

Solar gains	83.0383	162.3324	267.5781	391.3963	481.1893	493.3713	469.3779	402.0851	311.5099	192.6384	103.5073	68.3137 (83)
Total gains	664.1015	738.6485	821.2120	909.9947	963.9437	944.1715	901.6538	843.0940	772.8286	689.2096	639.1498	633.4871 (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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9920	0.9854	0.9664	0.9099	0.7878	0.6083	0.4512	0.5012	0.7504	0.9406	0.9853	0.9937 (86)
MIT	19.9554	20.1003	20.3496	20.6493	20.8729	20.9725	20.9949	20.9915	20.9248	20.6251	20.2248	19.9106 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9897	0.9811	0.9563	0.8835	0.7328	0.5243	0.3522	0.3977	0.6710	0.9171	0.9801	0.9918 (89)
MIT 2	19.0704	19.2135	19.4569	19.7383	19.9283	19.9975	20.0084	20.0073	19.9706	19.7232	19.3378	19.0260 (90)
Living area fraction	19.2200	19.3634	19.6077	19.8923	20.0880	20.1623	20.1751	20.1736	20.1319	19.8756	19.4877	19.1755 (92)
MIT	19.2200	19.3634	19.6077	19.8923	20.0880	20.1623	20.1751	20.1736	20.1319	19.8756	19.4877	19.1755 (92)
Temperature adjustment	19.0700	19.2134	19.4577	19.7423	19.9380	20.0123	20.0251	20.0236	19.9819	19.7256	19.3377	-0.1500
adjusted MIT	19.0700	19.2134	19.4577	19.7423	19.9380	20.0123	20.0251	20.0236	19.9819	19.7256	19.3377	19.0255 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9866	0.9765	0.9492	0.8751	0.7284	0.5246	0.3537	0.3992	0.6686	0.9087	0.9754	0.9892 (94)
Useful gains	655.2013	721.3223	779.4759	796.3651	702.1434	495.2847	318.9390	336.5419	516.6823	626.2963	623.4315	626.6309 (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	1380.3149	1337.6441	1210.9561	1013.2571	769.8732	505.8002	320.0882	338.6416	549.6859	852.8307	1143.6669	1385.5072 (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	539.4845	414.1683	321.0212	156.1623	50.3910	0.0000	0.0000	0.0000	0.0000	168.5416	374.5695	564.6040 (98)
Space heating												2588.9424 (98)
Space heating per m2											(98) / (4) =	30.1742 (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													2860.7098 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	539.4845	414.1683	321.0212	156.1623	50.3910	0.0000	0.0000	0.0000	0.0000	168.5416	374.5695	564.6040	(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)	596.1155	457.6445	354.7196	172.5550	55.6806	0.0000	0.0000	0.0000	0.0000	186.2338	413.8890	623.8718	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.7147	89.6332	89.4368	88.9839	88.1655	87.3000	87.3000	87.3000	87.3000	89.0150	89.5525	87.3000	(216)
(217)m	89.7147	89.6332	89.4368	88.9839	88.1655	87.3000	87.3000	87.3000	87.3000	89.0150	89.5525	89.7583	(217)
Fuel for water heating, kWh/month	188.6481	165.5820	172.2749	152.4283	148.7186	131.2463	123.2459	139.1132	140.0895	158.1531	169.7091	183.0905	(219)
Water heating fuel used	1872.2994											1872.2994	(219)
Annual totals kWh/year													
Space heating fuel - main system												2860.7098	(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)												58.0300	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												133.0300	(231)
Electricity for lighting (calculated in Appendix L)												387.0660	(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												4715.6555	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2860.7098	3.4800	99.5527 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1872.2994	3.4800	65.1560 (247)
Mechanical ventilation fans	58.0300	13.1900	7.6542 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.0660	13.1900	51.0540 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-537.4497	13.1900	-70.8896 (252)
Total energy cost			282.4198 (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] = 0.9069 (257)
SAP value	87.3494
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	2860.7098	0.2160	617.9133 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1872.2994	0.2160	404.4167 (264)
Space and water heating			1022.3300 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			1013.3234 (272)
CO2 emissions per m2			11.8100 (273)
EI value			89.6189
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	$3.48 / 0.8862 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8862 = 0.2437$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF 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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (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					4.4200
Infiltration rate					0.2210 (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)	=	0.1879 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.2207	0.2066	0.2066	0.1879	0.1925	0.1832	0.1832	0.1785	0.1785	0.1925	0.1879	0.1925 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (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	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734 (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			7.5000		25.1733		0.4500		0.0000		0.7700		65.4190 (76)
West			4.3500		25.1733		0.4500		0.0000		0.7700		37.9430 (80)
Solar gains	106.3954	176.9961	296.2177	432.8548	498.8167	565.0254	516.8159	463.3458	360.3332	226.4870	132.2015	82.8413	(83)
Total gains	687.4586	753.3122	849.8516	951.4532	981.5710	1015.8256	949.0918	904.3547	821.6519	723.0582	667.8440	648.0147	(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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9870	0.9789	0.9490	0.8608	0.6976	0.4635	0.3242	0.3298	0.6111	0.8863	0.9723	0.9896 (86)
MIT	20.1189	20.2305	20.4837	20.7688	20.9380	20.9933	20.9991	20.9991	20.9754	20.7788	20.4098	20.0866 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9829	0.9724	0.9335	0.8223	0.6279	0.3763	0.2273	0.2282	0.5143	0.8428	0.9619	0.9862 (89)
MIT 2	19.2325	19.3417	19.5853	19.8432	19.9756	20.0075	20.0095	20.0095	20.0001	19.8593	19.5187	19.2009 (90)
Living area fraction	fLA = Living area / (4) =											0.1690 (91)
MIT	19.3823	19.4919	19.7371	19.9996	20.1382	20.1741	20.1768	20.1768	20.1650	20.0147	19.6693	19.3506 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2323	19.3419	19.5871	19.8496	19.9882	20.0241	20.0268	20.0268	20.0150	19.8647	19.5193	19.2006 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9786	0.9668	0.9254	0.8152	0.6263	0.3776	0.2290	0.2300	0.5148	0.8352	0.9553	0.9825 (94)
Ext temp.	672.7458	728.2716	786.4784	775.5998	614.7212	383.5580	217.3438	208.0003	423.0270	603.9086	637.9719	636.6497 (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	1273.9967	1246.8540	1120.2481	911.1400	643.7329	385.4182	217.4474	208.1016	431.2881	725.6446	1020.4556	1261.6864 (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	447.3307	348.4874	248.3246	97.5889	21.5847	0.0000	0.0000	0.0000	0.0000	90.5716	275.3883	465.0274 (98)
Space heating per m2	(98) / (4) =											23.2436 (99)

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Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 90.5000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 2203.6504 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	447.3307	348.4874	248.3246	97.5889	21.5847	0.0000	0.0000	0.0000	0.0000	90.5716	275.3883	465.0274	(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)	494.2880	385.0690	274.3918	107.8331	23.8505	0.0000	0.0000	0.0000	0.0000	100.0791	304.2965	513.8424	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater (217)m	89.5985	89.5199	89.2474	88.6110	87.7385	87.3000	87.3000	87.3000	87.3000	88.5254	89.3355	87.3000	(216)
Fuel for water heating, kWh/month	188.8927	165.7916	172.6406	153.0697	149.4423	131.2463	123.2459	139.1132	140.0895	159.0277	170.1214	183.3280	(219)
Water heating fuel used												1876.0087	(219)
Annual totals kWh/year													
Space heating fuel - main system												2203.6504	(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) 58.0300 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 133.0300 (231)
 Electricity for lighting (calculated in Appendix L) 387.0660 (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 3989.9600 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2203.6504	10.2300	225.4334	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1876.0087	10.2300	191.9157	(247)
Mechanical ventilation fans	58.0300	36.7200	21.3086	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	387.0660	36.7200	142.1306	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			487.4116	(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	2203.6504	0.2160	475.9885	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1876.0087	0.2160	405.2179	(264)
Space and water heating			881.2064	(265)
Pumps and fans	133.0300	0.5190	69.0426	(267)
Energy for lighting	387.0660	0.5190	200.8872	(268)
Energy saving/generation technologies				
PV Unit	-609.7952	0.5190	-316.4837	(269)
Total kg/year			834.6525	(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	2203.6504	1.2200	2688.4535	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1876.0087	1.2200	2288.7306	(264)
Space and water heating			4977.1841	(265)
Pumps and fans	133.0300	3.0700	408.4023	(267)
Energy for lighting	387.0660	3.0700	1188.2925	(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			4701.8078 (272)
Primary energy kWh/m2/year			54.7996 (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	+ 1.2	-£ 83	-188 kg (22.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£83 2.20 kg/m²	B 89	B 91
Total Savings	£83 2.20 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 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	£191	£209	-£18
Mains gas	£520	£419	£102
Space heating	£377	£377	£0
Water heating	£192	£109	£83
Lighting	£142	£142	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£487	£404	£84
Total cost of uses	£487	£404	£83
Delivered energy	47 kWh/m²	36 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	42 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.2210 (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) =		0.1879 (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	0.2395	0.2348	0.2301	0.2066	0.2019	0.1785	0.1785	0.1738	0.1879	0.2019	0.2113	0.2207 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (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	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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												1.2122 (H8)
Utilisation factor												0.5617 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-853.2830 (H17)
Solar input	-24.7435	-41.2898	-70.3213	-94.2443	-116.4309	-114.4702	-112.9574	-98.6914	-77.2952	-52.7835	-29.3494	-20.7061 (63)
Solar input (sum of months) = Sum (63)m =												-853.2830 (63)
Output from w/h	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328 (64)
Total per year (kWh/year) = Sum (64)m =												813.5878 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790	(72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734	(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				7.5000	19.6403	0.4500		0.0000	0.7700		51.0401 (76)	
West				4.3500	19.6403	0.4500		0.0000	0.7700		29.6033 (80)	
Solar gains	83.0383	162.3324	267.5781	391.3963	481.1893	493.3713	469.3779	402.0851	311.5099	192.6384	103.5073	68.3137 (83)
Total gains	664.1015	738.6485	821.2120	909.9947	963.9437	944.1715	901.6538	843.0940	772.8286	689.2096	639.1498	633.4871 (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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9920	0.9854	0.9664	0.9099	0.7878	0.6083	0.4512	0.5012	0.7504	0.9406	0.9853	0.9937 (86)
MIT	19.9554	20.1003	20.3496	20.6493	20.8729	20.9725	20.9949	20.9915	20.9248	20.6251	20.2248	19.9106 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9897	0.9811	0.9563	0.8835	0.7328	0.5243	0.3522	0.3977	0.6710	0.9171	0.9801	0.9918 (89)
MIT 2	19.0704	19.2135	19.4569	19.7383	19.9283	19.9975	20.0084	20.0073	19.9706	19.7232	19.3378	19.0260 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.2200	19.3634	19.6077	19.8923	20.0880	20.1623	20.1751	20.1736	20.1319	19.8756	19.4877	19.1755 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0700	19.2134	19.4577	19.7423	19.9380	20.0123	20.0251	20.0236	19.9819	19.7256	19.3377	19.0255 (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	0.9866	0.9765	0.9492	0.8751	0.7284	0.5246	0.3537	0.3992	0.6686	0.9087	0.9754	0.9892	(94)
Useful gains	655.2013	721.3223	779.4759	796.3651	702.1434	495.2847	318.9390	336.5419	516.6823	626.2963	623.4315	626.6309	(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	1380.3149	1337.6441	1210.9561	1013.2571	769.8732	505.8002	320.0882	338.6416	549.6859	852.8307	1143.6669	1385.5072	(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	539.4845	414.1683	321.0212	156.1623	50.3910	0.0000	0.0000	0.0000	0.0000	168.5416	374.5695	564.6040	(98)
Space heating												2588.9424	(98)
Space heating per m2											(98) / (4) =	30.1742	(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													2860.7098	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	539.4845	414.1683	321.0212	156.1623	50.3910	0.0000	0.0000	0.0000	0.0000	168.5416	374.5695	564.6040	(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)	596.1155	457.6445	354.7196	172.5550	55.6806	0.0000	0.0000	0.0000	0.0000	186.2338	413.8890	623.8718	(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	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328	(64)	
Efficiency of water heater	89.8046	89.8234	89.8188	89.8102	89.7575	87.3000	87.3000	87.3000	87.3000	89.3762	89.6892	87.3000	(216)	
(217)m	89.8046	89.8234	89.8188	89.8102	89.7575	87.3000	87.3000	87.3000	87.3000	89.3762	89.6892	89.8322	(217)	
Fuel for water heating, kWh/month	160.9067	119.2637	93.2500	46.0886	16.3636	0.1235	0.0000	26.0645	51.5497	98.4562	136.7272	159.8901	(219)	
Water heating fuel used												908.6838	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2860.7098	(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)													58.0300	(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													183.0300	(231)
Electricity for lighting (calculated in Appendix L)													387.0660	(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													3802.0399	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2860.7098	3.4800	99.5527	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	908.6838	3.4800	31.6222	(247)
Mechanical ventilation fans	58.0300	13.1900	7.6542	(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	387.0660	13.1900	51.0540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			255.4809	(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] =	0.8204	(257)
SAP value		88.5561	
SAP rating (Section 12)		89	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2860.7098	0.2160	617.9133 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	908.6838	0.2160	196.2757 (264)
Space and water heating			814.1890 (265)
Pumps and fans	183.0300	0.5190	94.9926 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			831.1324 (272)
CO2 emissions per m2			9.6900 (273)
EI value			91.4853
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (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												4.4200
Infiltration rate												0.2210 (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) =	0.1879 (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												
	0.2207	0.2066	0.2066	0.1879	0.1925	0.1832	0.1832	0.1785	0.1785	0.1925	0.1879	0.1925 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (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)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (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	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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												1.3542 (H8)
Utilisation factor												0.5221 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-886.0488 (H17)
Solar input	-28.9129	-41.1174	-71.3493	-95.9768	-111.5315	-121.3139	-115.0241	-104.8908	-82.0978	-56.7431	-34.1974	-22.8937 (63)
Solar input (sum of months) = Sum (63)m =												-886.0488 (63)
Output from w/h	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452 (64)
Total per year (kWh/year) = Sum (64)m =												789.6247 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790	(72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734	(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					7.5000	25.1733		0.4500	0.0000	0.7700		65.4190 (76)
West					4.3500	25.1733		0.4500	0.0000	0.7700		37.9430 (80)
Solar gains	106.3954	176.9961	296.2177	432.8548	498.8167	565.0254	516.8159	463.3458	360.3332	226.4870	132.2015	82.8413 (83)
Total gains	687.4586	753.3122	849.8516	951.4532	981.5710	1015.8256	949.0918	904.3547	821.6519	723.0582	667.8440	648.0147 (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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9870	0.9789	0.9490	0.8608	0.6976	0.4635	0.3242	0.3298	0.6111	0.8863	0.9723	0.9896 (86)
MIT	20.1189	20.2305	20.4837	20.7688	20.9380	20.9933	20.9991	20.9991	20.9754	20.7788	20.4098	20.0866 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9829	0.9724	0.9335	0.8223	0.6279	0.3763	0.2273	0.2282	0.5143	0.8428	0.9619	0.9862 (89)
MIT 2	19.2325	19.3417	19.5853	19.8432	19.9756	20.0075	20.0095	20.0095	20.0001	19.8593	19.5187	19.2009 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.3823	19.4919	19.7371	19.9996	20.1382	20.1741	20.1768	20.1768	20.1650	20.0147	19.6693	19.3506 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2323	19.3419	19.5871	19.8496	19.9882	20.0241	20.0268	20.0268	20.0150	19.8647	19.5193	19.2006 (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	0.9786	0.9668	0.9254	0.8152	0.6263	0.3776	0.2290	0.2300	0.5148	0.8352	0.9553	0.9825	(94)
Useful gains	672.7458	728.2716	786.4784	775.5998	614.7212	383.5580	217.3438	208.0003	423.0270	603.9086	637.9719	636.6497	(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	1273.9967	1246.8540	1120.2481	911.1400	643.7329	385.4182	217.4474	208.1016	431.2881	725.6446	1020.4556	1261.6864	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	447.3307	348.4874	248.3246	97.5889	21.5847	0.0000	0.0000	0.0000	0.0000	90.5716	275.3883	465.0274	(98)
Space heating												1994.3036	(98)
Space heating per m2											(98) / (4) =	23.2436	(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													2203.6504	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	447.3307	348.4874	248.3246	97.5889	21.5847	0.0000	0.0000	0.0000	0.0000	90.5716	275.3883	465.0274	(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)	494.2880	385.0690	274.3918	107.8331	23.8505	0.0000	0.0000	0.0000	0.0000	100.0791	304.2965	513.8424	(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	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452	(64)	
Efficiency of water heater	89.7147	89.7257	89.6786	89.5515	88.9489	87.3000	87.3000	87.3000	87.3000	88.9311	89.5170	87.3000	(216)	
Fuel for water heating, kWh/month	156.4204	119.5857	92.2494	44.2872	22.0205	0.0000	0.0000	18.9633	46.0484	94.4967	131.5743	157.6292	(219)	
Water heating fuel used												883.2749	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2203.6504	(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)													58.0300	(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													183.0300	(231)
Electricity for lighting (calculated in Appendix L)													387.0660	(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													3047.2262	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2203.6504	10.2300	225.4334	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	883.2749	10.2300	90.3590	(247)
Mechanical ventilation fans	58.0300	36.7200	21.3086	(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	387.0660	36.7200	142.1306	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			404.2149	(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	2203.6504	0.2160	475.9885	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	883.2749	0.2160	190.7874	(264)
Space and water heating			666.7759	(265)
Pumps and fans	183.0300	0.5190	94.9926	(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	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			646.1720 (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	2203.6504	1.2200	2688.4535 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	883.2749	1.2200	1077.5954 (264)
Space and water heating			3766.0489 (265)
Pumps and fans	183.0300	3.0700	561.9023 (267)
Energy for lighting	387.0660	3.0700	1188.2925 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			3644.1725 (272)
Primary energy kWh/m2/year			42.4729 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	236.1 (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	285.97 (P1)
Transmission heat loss coefficient	57.71 (37)
Summer heat loss coefficient	343.68 (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	7.5000	125.2818	0.4500	0.0000	0.9000	380.5434
West	4.3500	125.2818	0.4500	0.0000	0.9000	220.7152
total:						624.2062

	Jun	Jul	Aug	
Solar gains	672	624	547	(P4)
Internal gains	448	429	438	
Total summer gains	1120	1053	986	(P5)
Summer gain/loss ratio	3.26	3.07	2.87	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 236.1)	0.35	0.35	0.35	
Threshold temperature	19.01	20.71	20.51	(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 72	Issued on Date	20/12/2023
Assessment Reference	72 Hedge	Prop Type Ref	21809
Property	6 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	13.82
Environmental	90 B	TER	18.01
CO ₂ Emissions (t/year)	0.83	% DER<TER	23.27
General Requirements Compliance	Pass	DfEE	45.75
		TfEE	51.40
		% DfEE<TfEE	10.99
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jpsustainability.co.uk		Assessor ID
			AU36-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.01	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.82	kgCO ₂ /m ²	Pass
	-4.19 (-23.3%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	51.40	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	45.75	kWh/m ² /yr	
	-5.6 (-10.9%)	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	4.42 (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

7.50 m², No overhang

Windows facing West

4.35 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

4.42 (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 72	Issued on Date	20/12/2023
Assessment Reference	72 Hedge	Prop Type Ref	21809
Property	6 Wayfaring Close, Southampton, SO30 0AT		

SAP Rating	87 B	DER	13.82	TER	18.01
Environmental	90 B	% DER<TER	23.27		
CO ₂ Emissions (t/year)	0.83	DFEE	45.75	TFEE	51.40
General Requirements Compliance	Pass	% DFEE<TFEE	10.99		

Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk	Assessor ID	AU36-0001
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Client	
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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, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	1.00 m	42.90 m ²	2.45 m
	1st Storey:	1.00 m	42.90 m ²	2.60 m

7.0 Living Area	14.50	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	236.11	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	94.94	80.44

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	44.95

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
stud	Plasterboard on timber frame		9.00	156.40	

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	42.90	42.90

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Other	9.00	42.90

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	42.90

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	42.90

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
entrance	Solid Door	[1] external	West							2.00	
front	Window	[1] external	West	None	0.00					4.35	
rear	Window	[1] external	East	None	0.00					7.50	
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)	10.90	0.300	No
Independently assessed	E3 Sill	8.30	0.015	No
Independently assessed	E4 Jamb	21.90	0.011	No
Independently assessed	E5 Ground floor (normal)	18.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	18.80	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	7.70	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.10	0.063	No
Independently assessed	E16 Corner (normal)	15.15	0.067	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.05	-0.090	No
Independently assessed	E18 Party wall between dwellings	10.20	0.042	No
Independently assessed	P1 Party wall - Ground floor	8.90	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.90	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.90	0.091	No

Y-value	0.042	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.42	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

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

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	Through Wall Fan Kitchen	1
0.18	In Room Fan Other Wet Room	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	23	
Total number of L.E.L. fittings	23	
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	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
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	£83	B 89	