

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 79			Issued on Date	12/10/2023
Assessment Reference	lpot 79 way	Prop Type Ref	21809		
Property	7 Wayfaring Close, Southampton, SO30 0AT				
SAP Rating	87 B	DER	14.43	TER	17.99
Environmental	89 B	% DER<TER	19.78		
CO ₂ Emissions (t/year)	0.89	DFEE	45.72	TFEE	51.07
General Requirements Compliance	Pass	% DFEE<TFEE	10.47		
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk			Assessor ID	AU36-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 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) 17.99 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.43 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.7 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:	4.64 (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 East: 4.35 m², No overhang
Windows facing West: 7.50 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 0.60 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.6400
Infiltration rate					0.2320 (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)	=	0.1972 (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	0.2514	0.2465	0.2416	0.2169	0.2120	0.1873	0.1873	0.1824	0.1972	0.2120	0.2219	0.2317 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5014	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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =	49.4715			(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) =	20355.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							237.2465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.0216 (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	35.8487	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	92.8702	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680 (39)
Average = Sum(39)m / 12 =												92.7765 (39)
HLP	1.0824	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812 (40)
HLP (average)												1.0813 (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)

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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	22.1719	19.6929	16.0153	12.1246	9.0633	7.6516	8.2678	10.7469	14.4244	18.3151	21.3764	22.7881 (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	391.8340	389.5529	375.2583	352.2847	328.9447	306.5864	292.1785	298.4455	310.3676	333.5583	360.1255	380.0606 (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
East					4.3500	19.6403		0.4500	0.0000	0.7700			29.6033 (76)
West					7.5000	19.6403		0.4500	0.0000	0.7700			51.0401 (80)

Solar gains	80.6434	157.7556	259.8010	378.9043	464.3615	475.3566	452.5589	388.7414	302.1594	187.1903	100.5529		66.3172 (83)
Total gains	472.4774	547.3085	635.0594	731.1891	793.3062	781.9430	744.7374	687.1869	612.5269	520.7487	460.6784		446.3778 (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	60.8847	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518
alpha	5.0590	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635
util living area	0.9983	0.9961	0.9881	0.9570	0.8680	0.7034	0.5360	0.5987	0.8529	0.9792	0.9965	0.9987 (86)
MIT	19.7530	19.9039	20.1706	20.5115	20.7988	20.9495	20.9896	20.9823	20.8640	20.4743	20.0403	19.7141 (87)
Th 2	20.0152	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162 (88)
util rest of house	0.9977	0.9948	0.9840	0.9417	0.8232	0.6163	0.4223	0.4815	0.7861	0.9692	0.9951	0.9983 (89)
MIT 2	18.8736	19.0248	19.2893	19.6202	19.8794	19.9925	20.0134	20.0109	19.9384	19.5900	19.1613	18.8356 (90)
Living area fraction	19.0222	19.1734	19.4382	19.7708	20.0347	20.1542	20.1784	20.1750	20.0948	19.7394	19.3098	18.9840 (92)
MIT	18.8722	19.0234	19.2882	19.6208	19.8847	20.0042	20.0284	20.0250	19.9448	19.5894	19.1598	18.8340 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9930	0.9799	0.9340	0.8162	0.6152	0.4237	0.4826	0.7803	0.9633	0.9934	0.9976 (94)
Ext temp.	470.9758	543.4540	622.3033	682.9318	647.5330	481.0174	315.5775	331.6209	477.9727	501.6262	457.6319	445.3035 (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	1353.3259	1310.1978	1186.3401	994.5510	759.2811	501.3384	318.0440	336.2879	542.2121	833.9333	1118.7649	1357.5690 (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	656.4685	515.2518	419.6434	224.3659	83.1405	0.0000	0.0000	0.0000	0.0000	247.2365	476.0157	678.7255 (98)
Space heating per m2												3300.8480 (98)
										(98) / (4) =		38.4714 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3647.3458 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	656.4685	515.2518	419.6434	224.3659	83.1405	0.0000	0.0000	0.0000	0.0000	247.2365	476.0157	678.7255	(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)	725.3795	569.3390	463.6944	247.9181	91.8680	0.0000	0.0000	0.0000	0.0000	273.1895	525.9843	749.9730	(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	89.8251	89.7642	89.6178	89.2672	88.5145	87.3000	87.3000	87.3000	87.3000	89.3122	89.7043	89.8579	(216)
(217)m	89.8251	89.7642	89.6178	89.2672	88.5145	87.3000	87.3000	87.3000	87.3000	89.3122	89.7043	89.8579	(217)
Fuel for water heating, kWh/month	188.4161	165.3405	171.9270	151.9445	148.1322	131.2463	123.2459	139.1132	140.0895	157.6268	169.4221	182.8874	(219)
Water heating fuel used												1869.3914	(219)
Annual totals kWh/year													
Space heating fuel - main system												3647.3458	(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)												391.5623	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 908 * 1.00) =										-435.7701		-435.7701	(233)
Total delivered energy for all uses												5605.5595	(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	3647.3458	0.2160	787.8267 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1869.3914	0.2160	403.7885 (264)
Space and water heating			1191.6152 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	391.5623	0.5190	203.2208 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total CO2, kg/year			1237.7140 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4300 (273)

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

DER	14.4300	ZC1
Total Floor Area	85.8000	TFA
Assumed number of occupants	2.5638	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.9634	ZC2
CO2 emissions from cooking, equation (L16)	2.1041	ZC3
Total CO2 emissions	32.4975	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	32.4975	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)			11.8500	1.3258	15.7102		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	13.8500	81.0900	0.1800	14.5962		(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) =		43.4604		(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) =	52.9524 (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	95.0349	94.7889	94.5477	93.4150	93.2030	92.2164	92.2164	92.0337	92.5965	93.2030	93.6318	94.0800 (39)
Average = Sum(39)m / 12 =												93.4139 (39)
HLP	Jan 1.1076	Feb 1.1048	Mar 1.1020	Apr 1.0888	May 1.0863	Jun 1.0748	Jul 1.0748	Aug 1.0727	Sep 1.0792	Oct 1.0863	Nov 1.0913	Dec 1.0965 (40)
HLP (average)												1.0887 (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	22.1719	19.6929	16.0153	12.1246	9.0633	7.6516	8.2678	10.7469	14.4244	18.3151	21.3764	22.7881	(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	404.2097	401.9326	387.1344	363.5242	339.5433	316.5460	302.1456	309.0510	321.6174	345.4448	372.5110	392.4402	(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
East					4.3500	19.6403	0.6300	0.7000			0.7700	26.1101 (76)
West					7.5000	19.6403	0.6300	0.7000			0.7700	45.0174 (80)

Solar gains	71.1275	139.1405	229.1445	334.1936	409.5668	419.2645	399.1569	342.8699	266.5046	165.1019	88.6876	58.4918 (83)
Total gains	475.3372	541.0730	616.2789	697.7179	749.1101	735.8105	701.3025	651.9209	588.1220	510.5466	461.1987	450.9320 (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	62.6963	62.8590	63.0193	63.7835	63.9285	64.6125	64.6125	64.7408	64.3473	63.9285	63.6358	63.3326	
alpha	5.1798	5.1906	5.2013	5.2522	5.2619	5.3075	5.3075	5.3161	5.2898	5.2619	5.2424	5.2222	
util living area	0.9986	0.9970	0.9913	0.9681	0.8948	0.7365	0.5648	0.6248	0.8737	0.9835	0.9972	0.9990	(86)
MIT	19.7729	19.9111	20.1608	20.4965	20.7824	20.9465	20.9893	20.9822	20.8613	20.4826	20.0689	19.7509	(87)
Th 2	19.9946	19.9969	19.9992	20.0100	20.0121	20.0215	20.0215	20.0232	20.0178	20.0121	20.0080	20.0037	(88)
util rest of house	0.9982	0.9960	0.9881	0.9556	0.8541	0.6488	0.4463	0.5043	0.8098	0.9749	0.9960	0.9986	(89)
MIT 2	18.3514	18.5548	18.9199	19.4083	19.7932	19.9848	20.0174	20.0156	19.9014	19.3965	18.7938	18.3256	(90)
Living area fraction	18.5916	18.7840	19.1296	19.5922	19.9604	20.1473	20.1816	20.1790	20.0636	19.5801	19.0093	18.5665	(91)
MIT	18.5916	18.7840	19.1296	19.5922	19.9604	20.1473	20.1816	20.1790	20.0636	19.5801	19.0093	18.5665	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5916	18.7840	19.1296	19.5922	19.9604	20.1473	20.1816	20.1790	20.0636	19.5801	19.0093	18.5665	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	473.9919	537.9006	606.5596	661.9654	637.9236	486.3656	327.0454	341.9333	478.3650	495.0718	458.5453	449.9577	(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	1358.2018	1316.0515	1194.1003	998.8142	769.8939	511.5524	330.2852	347.7928	552.2120	836.9696	1115.0885	1351.5996	(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	657.8522	522.9174	437.1303	242.5312	98.1859	0.0000	0.0000	0.0000	0.0000	254.3720	472.7111	670.8216	(98)
Space heating												3356.5216	(98)
Space heating per m2												39.1203	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3593.7062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	657.8522	522.9174	437.1303	242.5312	98.1859	0.0000	0.0000	0.0000	0.0000	254.3720	472.7111	670.8216	(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)	704.3385	559.8687	468.0196	259.6694	105.1241	0.0000	0.0000	0.0000	0.0000	272.3468	506.1147	718.2244	(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 (217)m	87.7668	87.5601	87.0884	85.9746	83.8253	80.3000	80.3000	80.3000	80.3000	85.9754	87.2805	87.8507	(217)
Fuel for water heating, kWh/month	234.7985	207.5066	217.5036	195.4138	194.0462	178.4080	170.9285	190.5452	192.6496	204.8889	214.9955	229.0029	(219)
Water heating fuel used												2430.6873	(219)
Annual totals kWh/year													
Space heating fuel - main system												3593.7062	(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)												391.5623	(232)
Total delivered energy for all uses												6490.9558	(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	3593.7062	0.2160	776.2405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2430.6873	0.2160	525.0285 (264)
Space and water heating			1301.2690 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	391.5623	0.5190	203.2208 (268)
Total CO2, kg/m2/year			1543.4148 (272)
Emissions per m2 for space and water heating			15.1663 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3685 (272b)
Emissions per m2 for pumps and fans			0.4537 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1663 * 1.00) + 2.3685 + 0.4537, rounded to 2 d.p.			17.9900 (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	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.6400
Infiltration rate					0.3705 (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) =	0.3149 (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	0.4015	0.3936	0.3858	0.3464	0.3385	0.2992	0.2992	0.2913	0.3149	0.3385	0.3543	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5628	0.5685 (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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =		49.4715		(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) = 20355.7505 (34)
237.2465 (35)
7.5500 (36)
(33) + (36) = 57.0216 (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	41.5089	41.2851	41.0658	40.0356	39.8429	38.9456	38.9456	38.7794	39.2912	39.8429	40.2328	40.6404 (38)
Heat transfer coeff	98.5305	98.3067	98.0874	97.0572	96.8644	95.9672	95.9672	95.8010	96.3128	96.8644	97.2544	97.6620 (39)
Average = Sum(39)m / 12 =												97.0563 (39)
HLP	1.1484	1.1458	1.1432	1.1312	1.1290	1.1185	1.1185	1.1166	1.1225	1.1290	1.1335	1.1383 (40)
HLP (average)												1.1312 (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
	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												

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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	22.1719	19.6929	16.0153	12.1246	9.0633	7.6516	8.2678	10.7469	14.4244	18.3151	21.3764	22.7881 (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	359.0676	357.5833	344.9465	324.2257	302.3490	282.0489	269.3874	273.4135	284.5369	305.3966	329.3321	348.0876 (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
East					4.3500	19.6403	0.4500	0.0000			0.7700	29.6033 (76)
West					7.5000	19.6403	0.4500	0.0000			0.7700	51.0401 (80)

Solar gains	80.6434	157.7556	259.8010	378.9043	464.3615	475.3566	452.5589	388.7414	302.1594	187.1903	100.5529	66.3172 (83)
Total gains	439.7110	515.3389	604.7476	703.1300	766.7105	757.4055	721.9463	662.1549	586.6963	492.5870	429.8849	414.4048 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.3871	57.5177	57.6463	58.2582	58.3741	58.9199	58.9199	59.0221	58.7085	58.3741	58.1401	57.8974
alpha	4.8258	4.8345	4.8431	4.8839	4.8916	4.9280	4.9280	4.9348	4.9139	4.8916	4.8760	4.8598
util living area	0.9987	0.9970	0.9908	0.9655	0.8896	0.7342	0.5669	0.6328	0.8782	0.9843	0.9974	0.9991 (86)
MIT	19.6237	19.7798	20.0600	20.4328	20.7495	20.9333	20.9851	20.9751	20.8288	20.4016	19.9439	19.5977 (87)
Th 2	19.9615	19.9636	19.9657	19.9754	19.9773	19.9858	19.9858	19.9873	19.9825	19.9773	19.9736	19.9697 (88)
util rest of house	0.9983	0.9960	0.9875	0.9526	0.8483	0.6456	0.4452	0.5090	0.8161	0.9764	0.9964	0.9988 (89)
MIT 2	18.7017	18.8592	19.1393	19.5117	19.8039	19.9538	19.9817	19.9797	19.8818	19.4879	19.0312	18.6823 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8575	19.0147	19.2949	19.6673	19.9637	20.1193	20.1513	20.1479	20.0419	19.6423	19.1854	18.8370 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8575	19.0147	19.2949	19.6673	19.9637	20.1193	20.1513	20.1479	20.0419	19.6423	19.1854	18.8370 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9948	0.9847	0.9477	0.8476	0.6583	0.4658	0.5298	0.8204	0.9729	0.9953	0.9983 (94)
Useful gains	438.6957	512.6338	595.4892	666.3441	649.8919	498.6127	336.3010	350.8187	481.3283	479.2290	427.8579	413.6876 (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	1434.3618	1387.5737	1255.0178	1045.0473	800.4585	529.6738	340.8058	359.0558	572.2785	875.8765	1175.3577	1429.4790 (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	740.7756	587.9596	490.6892	272.6663	112.0215	0.0000	0.0000	0.0000	0.0000	295.1057	538.1999	755.7488 (98)
Space heating	3793.1667 (98)											
Space heating per m2	(98) / (4) = 44.2094 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	902.0914	710.1570	728.0876	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8646	0.9239	0.8964	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	779.9214	656.0960	652.6597	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	982.0939	938.6870	870.6584	0.0000	0.0000	0.0000	0.0000 (103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	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	145.5642	210.2478	162.1911	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												518.0030 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	36.3910	52.5619	40.5478	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.5008 (107)
Space cooling per m2												1.5093 (108)
Energy for space heating												44.2094 (99)
Energy for space cooling												1.5093 (108)
Total												45.7187 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.7 (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 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
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (Uw = 1.40)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1300	5.5770		(28a)
external	94.9400	13.8500	81.0900	0.1800	14.5962		(29a)
cd	42.9000		42.9000	0.1300	5.5770		(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) =		43.4604		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4920 (36)
Total fabric heat loss						(33) + (36) =	52.9524 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.0825	41.8364	41.5953	40.4625	40.2506	39.2640	39.2640	39.0813	39.6440	40.2506	40.6793	41.1276 (38)
Average = Sum(39)m / 12 =	95.0349	94.7889	94.5477	93.4150	93.2030	92.2164	92.2164	92.0337	92.5965	93.2030	93.6318	94.0800 (39)
												93.4139 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1076	1.1048	1.1020	1.0888	1.0863	1.0748	1.0748	1.0727	1.0792	1.0863	1.0913	1.0965 (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												
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	Total = Sum(45)m = 1496.1255 (45)											
	(46)m = 0.15 x (45)m											
Water 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 (46)
Total storage loss:												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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	22.1719	19.6929	16.0153	12.1246	9.0633	7.6516	8.2678	10.7469	14.4244	18.3151	21.3764	22.7881	(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	359.0676	357.5833	344.9465	324.2257	302.3490	282.0489	269.3874	273.4135	284.5369	305.3966	329.3321	348.0876	(73)

6. Solar gains

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

Solar gains	71.1275	139.1405	229.1445	334.1936	409.5668	419.2645	399.1569	342.8699	266.5046	165.1019	88.6876	58.4918 (83)
Total gains	430.1951	496.7237	574.0910	658.4193	711.9158	701.3134	668.5443	616.2834	551.0415	470.4985	418.0197	406.5794 (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	62.6963	62.8590	63.0193	63.7835	63.9285	64.6125	64.6125	64.7408	64.3473	63.9285	63.6358	63.3326	
alpha	5.1798	5.1906	5.2013	5.2522	5.2619	5.3075	5.3075	5.3161	5.2898	5.2619	5.2424	5.2222	
util living area	0.9992	0.9980	0.9937	0.9747	0.9105	0.7611	0.5893	0.6547	0.8962	0.9884	0.9982	0.9994	(86)
MIT	19.7234	19.8628	20.1161	20.4592	20.7579	20.9374	20.9869	20.9780	20.8391	20.4415	20.0217	19.7021	(87)
Th 2	19.9946	19.9969	19.9992	20.0100	20.0121	20.0215	20.0215	20.0232	20.0178	20.0121	20.0080	20.0037	(88)
util rest of house	0.9989	0.9973	0.9913	0.9644	0.8736	0.6744	0.4673	0.5314	0.8387	0.9822	0.9975	0.9992	(89)
MIT 2	18.8233	18.9643	19.2183	19.5641	19.8428	19.9915	20.0180	20.0166	19.9227	19.5523	19.1321	18.8093	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.9754	19.1161	19.3700	19.7154	19.9975	20.1514	20.1818	20.1791	20.0775	19.7026	19.2824	18.9601	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9754	19.1161	19.3700	19.7154	19.9975	20.1514	20.1818	20.1791	20.0775	19.7026	19.2824	18.9601	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	429.5223	494.9553	567.9392	632.4344	621.4639	481.7795	326.2899	340.3618	464.4609	460.8368	416.6447	406.1082	(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	1394.6767	1347.5317	1216.8299	1010.3180	773.3513	511.9258	330.2971	347.8017	553.4991	848.3896	1140.6624	1388.6345	(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	718.0749	572.9313	482.7747	272.0762	113.0042	0.0000	0.0000	0.0000	0.0000	288.3393	521.2928	730.9995	(98)
Space heating												3699.4929	(98)
Space heating per m2											(98) / (4) =	43.1176	(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	866.8345	682.4016	699.4564	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8639	0.9260	0.8992	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	748.8977	631.9348	628.9732	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	916.5318	876.2692	817.0424	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	120.6965	181.7848	139.9235	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												442.4048	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	30.1741	45.4462	34.9809	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											110.6012 (107)
Space cooling per m2											1.2891 (108)
Energy for space heating											43.1176 (99)
Energy for space cooling											1.2891 (108)
Total											44.4067 (109)
Target Fabric Energy Efficiency (TFEE)											51.1 (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	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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6400		
Number of sides sheltered															0.2320 (18)		
															2 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1972 (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																	
	0.2317	0.2169	0.2169	0.1972	0.2021	0.1923	0.1923	0.1873	0.1873	0.2021	0.1972	0.2021	(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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =	49.4715			(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) =	20355.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							237.2465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.0216 (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	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680 (39)
Average = Sum(39)m / 12 =												92.7680 (39)
HLP	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812 (40)
HLP (average)												1.0812 (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	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)
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												
	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												
(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	55.4297	49.2322	40.0383	30.3116	22.6582	19.1290	20.6696	26.8671	36.0610	45.7877	53.4411	56.9703 (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	581.6997	576.8814	554.0936	518.9465	483.0145	451.0198	432.5133	441.3174	461.7327	497.0970	536.2562	565.8276 (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			
East				4.3500	25.1733	0.4500	0.0000	0.7700	37.9430 (76)			
West				7.5000	25.1733	0.4500	0.0000	0.7700	65.4190 (80)			
Solar gains	103.3620	172.0021	287.4636	418.6783	480.9070	543.8750	497.8162	447.5529	349.2817	220.0355	128.4584	80.4557 (83)
Total gains	685.0617	748.8835	841.5572	937.6248	963.9215	994.8948	930.3295	888.8704	811.0144	717.1325	664.7146	646.2833 (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	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518
Feb	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635
Mar	0.9873	0.9795	0.9505	0.8649	0.7041	0.4697	0.3283	0.3331	0.6147	0.8879	0.9728	0.9898 (86)
Apr	20.1306	20.2396	20.4879	20.7686	20.9374	20.9933	20.9991	20.9991	20.9757	20.7817	20.4179	20.0989 (87)
May	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162 (88)
Jun	0.9832	0.9731	0.9354	0.8270	0.6347	0.3820	0.2309	0.2312	0.5180	0.8448	0.9626	0.9864 (89)
Jul	19.2491	19.3557	19.5948	19.8492	19.9817	20.0141	20.0161	20.0161	20.0068	19.8677	19.5317	19.2181 (90)
Aug	19.3980	19.5051	19.7457	20.0046	20.1432	20.1796	20.1822	20.1822	20.1706	20.0222	19.6815	19.3670 (91)
Sep	19.2480	19.3551	19.5957	19.8546	19.9932	20.0296	20.0322	20.0322	20.0206	19.8722	19.5315	19.2170 (92)
Oct												
Nov												
Dec												

8. Space heating requirement

Utilisation	0.9790	0.9676	0.9274	0.8199	0.6329	0.3832	0.2324	0.2329	0.5184	0.8373	0.9560	0.9828 (94)
Useful gains	670.6917	724.5842	780.4874	768.7616	610.0830	381.2075	216.2529	206.9795	420.4645	600.4687	635.4795	635.1624 (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	1266.1020	1238.9245	1112.8190	904.9157	639.4711	383.0903	216.3559	207.0789	428.6395	721.0071	1014.0907	1253.9443 (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	442.9853	345.6367	247.2547	98.0310	21.8648	0.0000	0.0000	0.0000	0.0000	89.6806	272.6001	460.3738 (98)
Space heating												
RHI space heating demand												1978.4269 (98)
												1978 (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 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					4.6400
Infiltration rate					0.2320 (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) =		0.1972 (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	0.2514	0.2465	0.2416	0.2169	0.2120	0.1873	0.1873	0.1824	0.1972	0.2120	0.2219	0.2317 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5014	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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =	49.4715			(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) =	20355.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							237.2465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.0216 (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	35.8487	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	92.8702	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680 (39)
Average = Sum(39)m / 12 =												92.7765 (39)
HLP	1.0824	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812 (40)
HLP (average)												1.0813 (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)
								Solar input (sum of months) =	Sum (63)m =			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)
								Total per year (kWh/year) =	Sum (64)m =			1661.5070 (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	55.4297	49.2322	40.0383	30.3116	22.6582	19.1290	20.6696	26.8671	36.0610	45.7877	53.4411	56.9703 (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	581.6997	576.8814	554.0936	518.9465	483.0145	451.0198	432.5133	441.3174	461.7327	497.0970	536.2562	565.8276 (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	
East				4.3500	19.6403		0.4500		0.0000	0.7700	29.6033 (76)	
West				7.5000	19.6403		0.4500		0.0000	0.7700	51.0401 (80)	

Solar gains	80.6434	157.7556	259.8010	378.9043	464.3615	475.3566	452.5589	388.7414	302.1594	187.1903	100.5529	66.3172 (83)
Total gains	662.3431	734.6371	813.8947	897.8508	947.3760	926.3764	885.0721	830.0588	763.8921	684.2874	636.8090	632.1448 (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	60.8847	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518
alpha	5.0590	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635
util living area	0.9922	0.9858	0.9674	0.9129	0.7937	0.6150	0.4562	0.5053	0.7536	0.9417	0.9856	0.9938 (86)
MIT	19.9674	20.1109	20.3554	20.6500	20.8719	20.9722	20.9949	20.9916	20.9255	20.6297	20.2351	19.9249 (87)
Th 2	20.0152	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162 (88)
util rest of house	0.9899	0.9816	0.9576	0.8871	0.7393	0.5309	0.3568	0.4017	0.6746	0.9185	0.9805	0.9919 (89)
MIT 2	19.0865	19.2290	19.4678	19.7449	19.9340	20.0039	20.0149	20.0138	19.9775	19.7331	19.3530	19.0452 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.2353	19.3780	19.6178	19.8979	20.0925	20.1676	20.1805	20.1791	20.1377	19.8846	19.5021	19.1939 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0853	19.2280	19.4678	19.7479	19.9425	20.0176	20.0305	20.0291	19.9877	19.7346	19.3521	19.0439 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	653.6619	717.8542	773.7366	789.0385	696.1224	491.9198	317.0926	334.5799	513.4302	622.8716	621.4497	625.4498 (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	1373.1174	1329.1820	1202.9994	1006.3367	764.6445	502.5754	318.2429	336.6628	546.1931	847.4002	1136.6044	1377.0376 (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	535.2750	410.8123	319.3715	156.4547	50.9804	0.0000	0.0000	0.0000	0.0000	167.0493	370.9114	559.1813 (98)
Space heating												2570.0358 (98)
Space heating per m ²										(98) / (4) =		29.9538 (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													2839.8186 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	535.2750	410.8123	319.3715	156.4547	50.9804	0.0000	0.0000	0.0000	0.0000	167.0493	370.9114	559.1813	(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)	591.4640	453.9362	352.8967	172.8781	56.3319	0.0000	0.0000	0.0000	0.0000	184.5849	409.8469	617.8799	(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	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	89.7101	89.6281	89.4332	88.9853	88.1728	87.3000	87.3000	87.3000	87.3000	89.0079	89.5460	87.3000	(216)
Fuel for water heating, kWh/month	188.6578	165.5915	172.2820	152.4258	148.7062	131.2463	123.2459	139.1132	140.0895	158.1657	169.7215	183.1018	(219)
Water heating fuel used												1872.3471	(219)
Annual totals kWh/year													
Space heating fuel - main system												2839.8186	(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)													391.5623 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 908 * 1.00) =										-435.7701		-435.7701	(233)
Total delivered energy for all uses												4800.9879	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2839.8186	3.4800	98.8257 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1872.3471	3.4800	65.1577 (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	391.5623	13.1900	51.6471 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-435.7701	13.1900	-57.4781 (252)
Total energy cost			295.6990 (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] =	0.9495 (257)
SAP value		86.7546
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	2839.8186	0.2160	613.4008 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1872.3471	0.2160	404.4270 (264)
Space and water heating			1017.8278 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	391.5623	0.5190	203.2208 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total kg/year			1063.9265 (272)
CO2 emissions per m2			12.4000 (273)
EI value			89.1004
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency $3.48 / 0.8862 = 3.927$, 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	=	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														4.6400			
Infiltration rate														0.2320 (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) =				0.1972 (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																	
	0.2317	0.2169	0.2169	0.1972	0.2021	0.1923	0.1923	0.1873	0.1873	0.2021	0.1972	0.2021 (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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =	49.4715			(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) =	20355.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							237.2465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.0216 (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	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680 (39)
Average = Sum(39)m / 12 =												92.7680 (39)
HLP	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812 (40)
HLP (average)												1.0812 (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)
												Solar input (sum of months) = Sum (63)m = 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)
												Total per year (kWh/year) = Sum (64)m = 1661.5070 (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													
	55.4297	49.2322	40.0383	30.3116	22.6582	19.1290	20.6696	26.8671	36.0610	45.7877	53.4411	56.9703	(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	581.6997	576.8814	554.0936	518.9465	483.0145	451.0198	432.5133	441.3174	461.7327	497.0970	536.2562	565.8276	(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	
East				4.3500	25.1733	0.4500		0.0000		0.7700		37.9430	
West				7.5000	25.1733	0.4500		0.0000		0.7700		65.4190 (76)	
Solar gains	103.3620	172.0021	287.4636	418.6783	480.9070	543.8750	497.8162	447.5529	349.2817	220.0355	128.4584	80.4557 (83)	
Total gains	685.0617	748.8835	841.5572	937.6248	963.9215	994.8948	930.3295	888.8704	811.0144	717.1325	664.7146	646.2833 (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	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518
alpha	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635
util living area	0.9873	0.9795	0.9505	0.8649	0.7041	0.4697	0.3283	0.3331	0.6147	0.8879	0.9728	0.9898 (86)
MIT	20.1306	20.2396	20.4879	20.7686	20.9374	20.9933	20.9991	20.9991	20.9757	20.7817	20.4179	20.0989 (87)
Th 2	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162 (88)
util rest of house	0.9832	0.9731	0.9354	0.8270	0.6347	0.3820	0.2309	0.2312	0.5180	0.8448	0.9626	0.9864 (89)
MIT 2	19.2491	19.3557	19.5948	19.8492	19.9817	20.0141	20.0161	20.0161	20.0068	19.8677	19.5317	19.2181 (90)
Living area fraction	19.3980	19.5051	19.7457	20.0046	20.1432	20.1796	20.1822	20.1822	20.1706	20.0222	19.6815	19.3670 (91)
MIT	19.3980	19.5051	19.7457	20.0046	20.1432	20.1796	20.1822	20.1822	20.1706	20.0222	19.6815	19.3670 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2480	19.3551	19.5957	19.8546	19.9932	20.0296	20.0322	20.0322	20.0206	19.8722	19.5315	19.2170 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9676	0.9274	0.8199	0.6329	0.3832	0.2324	0.2329	0.5184	0.8373	0.9560	0.9828	(94)
Useful gains	670.6917	724.5842	780.4874	768.7616	610.0830	381.2075	216.2529	206.9795	420.4645	600.4687	635.4795	635.1624	(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	1266.1020	1238.9245	1112.8190	904.9157	639.4711	383.0903	216.3559	207.0789	428.6395	721.0071	1014.0907	1253.9443	(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	442.9853	345.6367	247.2547	98.0310	21.8648	0.0000	0.0000	0.0000	0.0000	89.6806	272.6001	460.3738	(98)
Space heating												1978.4269	(98)
Space heating per m2												(98) / (4) = 23.0586	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2186.1071 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	442.9853	345.6367	247.2547	98.0310	21.8648	0.0000	0.0000	0.0000	0.0000	89.6806	272.6001	460.3738	(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)	489.4865	381.9190	273.2097	108.3215	24.1600	0.0000	0.0000	0.0000	0.0000	99.0945	301.2156	508.7003	(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	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	89.5922	89.5143	89.2441	88.6145	87.7434	87.3000	87.3000	87.3000	87.3000	88.5180	89.3279	89.6357	(216)
Fuel for water heating, kWh/month	188.9061	165.8020	172.6469	153.0636	149.4340	131.2463	123.2459	139.1132	140.0895	159.0412	170.1358	183.3409	(219)
Water heating fuel used													1876.0652 (219)
Annual totals kWh/year													
Space heating fuel - main system													2186.1071 (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)													391.5623 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1030 * 1.00) =										-494.4285			-494.4285 (233)
Total delivered energy for all uses													4092.3361 (238)

10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2186.1071	10.2300	223.6388 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1876.0652	10.2300	191.9215 (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	391.5623	36.7200	143.7817 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.4285	36.7200	-181.5542 (252)
Total energy cost			529.6364 (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	2186.1071	0.2160	472.1991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1876.0652	0.2160	405.2301 (264)
Space and water heating			877.4292 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	391.5623	0.5190	203.2208 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	0.5190	-256.6084 (269)
Total kg/year			893.0842 (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	2186.1071	1.2200	2667.0506 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1876.0652	1.2200	2288.7995 (264)
Space and water heating			4955.8501 (265)
Pumps and fans	133.0300	3.0700	408.4023 (267)
Energy for lighting	391.5623	3.0700	1202.0962 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	3.0700	-1517.8956 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/year
Primary energy kWh/m²/year

5048.4530 (272)
58.8398 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 83	-188 kg (21.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£83 2.20 kg/m ²	B 88	B 91
Total Savings	£83 2.20 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 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	£193	£211	-£18
Mains gas	£519	£417	£102
Space heating	£375	£375	£0
Water heating	£192	£109	£83
Lighting	£144	£144	£0
Generated (PV)	-£182	-£182	£0
Total cost of fuels	£530	£446	£84
Total cost of uses	£529	£446	£83
Delivered energy	48 kWh/m ²	37 kWh/m ²	11 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	59 kWh/m ²	47 kWh/m ²	12 kWh/m ²

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	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												4.6400
Infiltration rate												0.2320 (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) =	0.1972 (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												
	0.2514	0.2465	0.2416	0.2169	0.2120	0.1873	0.1873	0.1824	0.1972	0.2120	0.2219	0.2317 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5014	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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =	49.4715			(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) =	20355.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							237.2465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.0216 (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	35.8487	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	92.8702	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680 (39)
Average = Sum(39)m / 12 =												92.7765 (39)
HLP	Jan 1.0824	Feb 1.0812	Mar 1.0812	Apr 1.0812	May 1.0812	Jun 1.0812	Jul 1.0812	Aug 1.0812	Sep 1.0812	Oct 1.0812	Nov 1.0812	Dec 1.0812 (40)
HLP (average)												1.0813 (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)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	55.4297	49.2322	40.0383	30.3116	22.6582	19.1290	20.6696	26.8671	36.0610	45.7877	53.4411	56.9703	(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	581.6997	576.8814	554.0936	518.9465	483.0145	451.0198	432.5133	441.3174	461.7327	497.0970	536.2562	565.8276	(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		
East					4.3500	19.6403	0.4500	0.0000	0.7700	29.6033 (76)		
West					7.5000	19.6403	0.4500	0.0000	0.7700	51.0401 (80)		

Solar gains	80.6434	157.7556	259.8010	378.9043	464.3615	475.3566	452.5589	388.7414	302.1594	187.1903	100.5529	66.3172 (83)
Total gains	662.3431	734.6371	813.8947	897.8508	947.3760	926.3764	885.0721	830.0588	763.8921	684.2874	636.8090	632.1448 (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	60.8847	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518
alpha	5.0590	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635
util living area												
	0.9922	0.9858	0.9674	0.9129	0.7937	0.6150	0.4562	0.5053	0.7536	0.9417	0.9856	0.9938 (86)
MIT	19.9674	20.1109	20.3554	20.6500	20.8719	20.9722	20.9949	20.9916	20.9255	20.6297	20.2351	19.9249 (87)
Th 2	20.0152	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162 (88)
util rest of house												
	0.9899	0.9816	0.9576	0.8871	0.7393	0.5309	0.3568	0.4017	0.6746	0.9185	0.9805	0.9919 (89)
MIT 2	19.0865	19.2290	19.4678	19.7449	19.9340	20.0039	20.0149	20.0138	19.9775	19.7331	19.3530	19.0452 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.2353	19.3780	19.6178	19.8979	20.0925	20.1676	20.1805	20.1791	20.1377	19.8846	19.5021	19.1939 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0853	19.2280	19.4678	19.7479	19.9425	20.0176	20.0305	20.0291	19.9877	19.7346	19.3521	19.0439 (93)

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	2839.8186	0.2160	613.4008 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	908.7237	0.2160	196.2843 (264)
Space and water heating			809.6851 (265)
Pumps and fans	183.0300	0.5190	94.9926 (267)
Energy for lighting	391.5623	0.5190	203.2208 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total kg/year			881.7339 (272)
CO2 emissions per m2			10.2800 (273)
EI value			90.9669
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	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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6400		
Number of sides sheltered															0.2320 (18)		
															2 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1972 (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																	
	0.2317	0.2169	0.2169	0.1972	0.2021	0.1923	0.1923	0.1873	0.1873	0.2021	0.1972	0.2021	(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)			11.8500	1.3258	15.7102		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	13.8500	81.0900	0.2700	21.8943	150.0000	12163.5004 (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) =	49.4715			(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) =	20355.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							237.2465 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.0216 (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	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680	92.7680 (39)
Average = Sum(39)m / 12 =												92.7680 (39)
HLP	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812	1.0812 (40)
HLP (average)												1.0812 (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 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												
(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	55.4297	49.2322	40.0383	30.3116	22.6582	19.1290	20.6696	26.8671	36.0610	45.7877	53.4411	56.9703 (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	581.6997	576.8814	554.0936	518.9465	483.0145	451.0198	432.5133	441.3174	461.7327	497.0970	536.2562	565.8276 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East		4.3500	25.1733	0.4500	0.0000		0.7700	37.9430 (76)
West		7.5000	25.1733	0.4500	0.0000		0.7700	65.4190 (80)

Solar gains	103.3620	172.0021	287.4636	418.6783	480.9070	543.8750	497.8162	447.5529	349.2817	220.0355	128.4584	80.4557 (83)
Total gains	685.0617	748.8835	841.5572	937.6248	963.9215	994.8948	930.3295	888.8704	811.0144	717.1325	664.7146	646.2833 (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	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518	60.9518
alpha	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635	5.0635
util living area	0.9873	0.9795	0.9505	0.8649	0.7041	0.4697	0.3283	0.3331	0.6147	0.8879	0.9728	0.9898 (86)
MIT	20.1306	20.2396	20.4879	20.7686	20.9374	20.9933	20.9991	20.9991	20.9757	20.7817	20.4179	20.0989 (87)
Th 2	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162	20.0162 (88)
util rest of house	0.9832	0.9731	0.9354	0.8270	0.6347	0.3820	0.2309	0.2312	0.5180	0.8448	0.9626	0.9864 (89)
MIT 2	19.2491	19.3557	19.5948	19.8492	19.9817	20.0141	20.0161	20.0161	20.0068	19.8677	19.5317	19.2181 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.3980	19.5051	19.7457	20.0046	20.1432	20.1796	20.1822	20.1822	20.1706	20.0222	19.6815	19.3670 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2480	19.3551	19.5957	19.8546	19.9932	20.0296	20.0322	20.0322	20.0206	19.8722	19.5315	19.2170 (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	0.9790	0.9676	0.9274	0.8199	0.6329	0.3832	0.2324	0.2329	0.5184	0.8373	0.9560	0.9828	(94)
Useful gains	670.6917	724.5842	780.4874	768.7616	610.0830	381.2075	216.2529	206.9795	420.4645	600.4687	635.4795	635.1624	(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	1266.1020	1238.9245	1112.8190	904.9157	639.4711	383.0903	216.3559	207.0789	428.6395	721.0071	1014.0907	1253.9443	(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	442.9853	345.6367	247.2547	98.0310	21.8648	0.0000	0.0000	0.0000	0.0000	89.6806	272.6001	460.3738	(98)
Space heating												1978.4269	(98)
Space heating per m2											(98) / (4) =	23.0586	(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													2186.1071	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	442.9853	345.6367	247.2547	98.0310	21.8648	0.0000	0.0000	0.0000	0.0000	89.6806	272.6001	460.3738	(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)	489.4865	381.9190	273.2097	108.3215	24.1600	0.0000	0.0000	0.0000	0.0000	99.0945	301.2156	508.7003	(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	89.7089	89.7209	89.6759	89.5545	88.9592	87.3000	87.3000	87.3000	87.3000	88.9232	89.5101	89.7270	(217)	
Fuel for water heating, kWh/month	156.4305	119.5921	92.2521	44.2857	22.0179	0.0000	0.0000	18.9633	46.0484	94.5051	131.5845	157.6395	(219)	
Water heating fuel used												883.3191	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2186.1071	(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)													391.5623	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1030 * 1.00) =													-494.4285	(233)
Total delivered energy for all uses													3149.5900	(238)

10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2186.1071	10.2300	223.6388	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	883.3191	10.2300	90.3635	(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	391.5623	36.7200	143.7817	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.4285	36.7200	-181.5542	(252)
Total energy cost			446.4385	(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	2186.1071	0.2160	472.1991	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	883.3191	0.2160	190.7969	(264)
Space and water heating			662.9961	(265)
Pumps and fans	183.0300	0.5190	94.9926	(267)
Energy for lighting	391.5623	0.5190	203.2208	(268)

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 saving/generation technologies			
PV Unit	-494.4285	0.5190	-256.6084 (269)
Total kg/year			704.6011 (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	2186.1071	1.2200	2667.0506 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	883.3191	1.2200	1077.6493 (264)
Space and water heating			3744.6999 (265)
Pumps and fans	183.0300	3.0700	561.9023 (267)
Energy for lighting	391.5623	3.0700	1202.0962 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	3.0700	-1517.8956 (269)
Primary energy kWh/year			3990.8028 (272)
Primary energy kWh/m2/year			46.5129 (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	East
Overshading	Average or unknown
Thermal mass parameter	237.2 (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	57.02 (37)
Summer heat loss coefficient	342.99 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
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
East	4.3500	125.2818	0.4500	0.0000	0.9000	220.7152
West	7.5000	125.2818	0.4500	0.0000	0.9000	380.5434

total: 601.2586

Solar gains	Jun 647	Jul 601	Aug 529	(P4)
Internal gains	448	430	438	
Total summer gains	1095	1031	967	(P5)

Summer gain/loss ratio	3.19	3.01	2.82	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 237.2)	0.34	0.34	0.34	
Threshold temperature	18.93	20.64	20.46	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 79	Issued on Date	12/10/2023
Assessment Reference	lpot 79 way	Prop Type Ref	21809
Property	7 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	14.43
Environmental	89 B	TER	17.99
CO ₂ Emissions (t/year)	0.89	% DER<TER	19.78
General Requirements Compliance	Pass	DfEE	45.72
		TfEE	51.07
		% DfEE<TfEE	10.47
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jpsustainability.co.uk		Assessor ID
			AU36-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.99	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.43	kgCO ₂ /m ²	Pass
	-3.56 (-19.8%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	51.07	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	45.72	kWh/m ² /yr	
	-5.4 (-10.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.64 (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 East

4.35 m², No overhang

Windows facing West

7.50 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.64 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

0.60

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 79	Issued on Date	12/10/2023
Assessment Reference	Plot 79 way	Prop Type Ref	21809
Property	7 Wayfaring Close, Southampton, SO30 0AT		

SAP Rating	87 B	DER	14.43	TER	17.99
Environmental	89 B	% DER<TER	19.78		
CO ₂ Emissions (t/year)	0.89	DFEE	45.72	TFEE	51.07
General Requirements Compliance	Pass	% DFEE<TFEE	10.47		

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	East
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	237.25	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	81.09

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/m ² K)	Area (m ²)
internal	Other	9.00	42.90

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	42.90

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
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/m ² K)
entrance	Manufacturer	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft 0.05			0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
entrance	Solid Door	[1] external	East							2.00	
front	Window	[1] external	East	None	0.00					4.35	
rear	Window	[1] external	West	None	0.00					7.50	

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/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	5.01	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.64	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

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

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	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	
Flue Type	Balanced	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.60	West	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 88	