

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 82			Issued on Date	12/10/2023
Assessment Reference	plot 82 way	Prop Type Ref	21809		
Property	1 Wayfaring Close, Southampton, SO30 0AT				
SAP Rating	87 B	DER	14.45	TER	18.04
Environmental	89 B	% DER<TER	19.89		
CO ₂ Emissions (t/year)	0.90	DFEE	46.00	TFEE	51.73
General Requirements Compliance	Pass	% DFEE<TFEE	11.08		
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) 18.04 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.45 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.0 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	1.35 (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:	4.45 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1600 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North: 1.30 m², No overhang

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/m ² K
Roof U-value	0.11 W/m ² K
Floor U-value	0.12 W/m ² K
Door U-value	1.00 W/m ² K
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	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.4500
Infiltration rate					0.2225 (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) =		0.1891 (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	0.2411	0.2364	0.2317	0.2080	0.2033	0.1797	0.1797	0.1749	0.1891	0.2033	0.2128	0.2222 (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)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =	50.8440			(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) =	20160.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							234.9738 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	58.3941 (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	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405 (39)
Average = Sum(39)m / 12 =												94.1405 (39)
HLP	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972 (40)
HLP (average)												1.0972 (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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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.6852	19.2606	15.6638	11.8585	8.8643	7.4837	8.0864	10.5110	14.1078	17.9131	20.9072	22.2879	(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	391.3473	389.1206	374.9068	352.0186	328.7458	306.4184	291.9970	298.2096	310.0509	333.1563	359.6563	379.5604	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				1.3000	10.6334	0.4500	0.0000			0.7700			4.7898 (74)
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	85.4332	166.9092	275.3552	403.8883	498.0172	511.3860	486.1969	415.4289	320.8605	198.0865	106.4617	70.3102	(83)
Total gains	476.7805	556.0298	650.2620	755.9069	826.7629	817.8044	778.1940	713.6385	630.9114	531.2428	466.1180	449.8706	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878
alpha	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659
util living area	0.9981	0.9956	0.9867	0.9519	0.8553	0.6860	0.5212	0.5858	0.8443	0.9774	0.9962	0.9986 (86)
MIT	19.7273	19.8831	20.1601	20.5130	20.8045	20.9518	20.9899	20.9826	20.8643	20.4662	20.0199	19.6855 (87)
Th 2	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031 (88)
util rest of house	0.9975	0.9942	0.9822	0.9353	0.8082	0.5983	0.4087	0.4690	0.7755	0.9667	0.9947	0.9982 (89)
MIT 2	18.8391	18.9943	19.2688	19.6104	19.8714	19.9807	20.0004	19.9979	19.9260	19.5717	19.1312	18.7973 (90)
Living area fraction	18.9892	19.1445	19.4194	19.7629	20.0291	20.1448	20.1677	20.1643	20.0846	19.7228	19.2814	18.9474 (92)
Temperature adjustment	18.8392	18.9945	19.2694	19.6129	19.8791	19.9948	20.0177	20.0143	19.9346	19.5728	19.1314	18.7974 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9965	0.9922	0.9777	0.9271	0.8014	0.5976	0.4104	0.4704	0.7700	0.9604	0.9928	0.9974 (94)
Useful gains	475.1255	551.7055	635.7730	700.8113	662.6030	488.6806	319.3783	335.6999	485.7753	510.2155	462.7638	448.6871 (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	1368.7263	1326.8628	1202.1214	1008.5211	769.9827	507.8690	321.7401	340.2535	549.2691	844.7083	1132.6405	1374.2068 (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	664.8390	520.9057	421.3632	221.5511	79.8905	0.0000	0.0000	0.0000	0.0000	248.8626	482.3112	688.5866 (98)
Space heating												3328.3099 (98)
Space heating per m2												(98) / (4) = 38.7915 (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												3677.6905 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	664.8390	520.9057	421.3632	221.5511	79.8905	0.0000	0.0000	0.0000	0.0000	248.8626	482.3112	688.5866 (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)	734.6287	575.5865	465.5946	244.8079	88.2768	0.0000	0.0000	0.0000	0.0000	274.9863	532.9405	760.8692 (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	89.8319	89.7703	89.6204	89.2576	88.4846	87.3000	87.3000	87.3000	87.3000	89.3171	89.7121	87.3000 (216)
Fuel for water heating, kWh/month	188.4020	165.3291	171.9220	151.9608	148.1823	131.2463	123.2459	139.1132	140.0895	157.6182	169.4073	182.8724 (219)
Water heating fuel used												1869.3889 (219)
Annual totals kWh/year												
Space heating fuel - main system												3677.6905 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)												
mechanical ventilation fans (SFP = 0.2196)												58.0300 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												133.0300 (231)
Electricity for lighting (calculated in Appendix L)												382.9671 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.60 * 908 * 1.00) =												-435.7701 (233)
Total delivered energy for all uses												5627.3065 (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	3677.6905	0.2160	794.3812 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1869.3889	0.2160	403.7880 (264)
Space and water heating			1198.1692 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	382.9671	0.5190	198.7599 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total CO2, kg/year			1239.8070 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4500 (273)

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

DER			14.4500 ZC1
Total Floor Area		TFA	85.8000
Assumed number of occupants		N	2.5638
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.9634 ZC2
CO2 emissions from cooking, equation (L16)			2.1041 ZC3
Total CO2 emissions			32.5175 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			32.5175 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	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					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)			13.1500	1.3258	17.4337		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	15.1500	79.7900	0.1800	14.3622		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9499		(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) =	54.4419 (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	96.5244	96.2783	96.0372	94.9044	94.6925	93.7059	93.7059	93.5232	94.0859	94.6925	95.1212	95.5695 (39)
Average = Sum(39)m / 12 =												94.9034 (39)
HLP	Jan 1.1250	Feb 1.1221	Mar 1.1193	Apr 1.1061	May 1.1036	Jun 1.0921	Jul 1.0921	Aug 1.0900	Sep 1.0966	Oct 1.1036	Nov 1.1086	Dec 1.1139 (40)
HLP (average)												1.1061 (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)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
	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)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			2061.0611 (64)
	64.3159	56.6157	58.9047	52.0708	50.3266	44.1527	42.0396	47.1173	47.6456	54.4936	58.3248	62.6885 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.6852	19.2606	15.6638	11.8585	8.8643	7.4837	8.0864	10.5110	14.1078	17.9131	20.9072	22.2879	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	86.4461	84.2495	79.1729	72.3205	67.6432	61.3231	56.5048	63.3297	66.1745	73.2441	81.0067	84.2587	(72)
Total internal gains	403.7230	401.5003	386.7828	363.2581	339.3443	316.3780	301.9641	308.8151	321.3008	345.0427	372.0418	391.9400	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.3000	10.6334		0.6300	0.7000	0.7700	4.2246 (74)		
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	75.3521	147.2139	242.8633	356.2295	439.2511	451.0425	428.8257	366.4083	282.9990	174.7123	93.8992	62.0136	(83)
Total gains	479.0751	548.7142	629.6461	719.4876	778.5955	767.4205	730.7898	675.2234	604.2997	519.7550	465.9410	453.9536	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7288	61.8865	62.0419	62.7825	62.9230	63.5855	63.5855	63.7097	63.3286	62.9230	62.6394	62.3456	
alpha	5.1153	5.1258	5.1361	5.1855	5.1949	5.2390	5.2390	5.2473	5.2219	5.1949	5.1760	5.1564	
util living area	0.9986	0.9968	0.9906	0.9650	0.8855	0.7217	0.5516	0.6140	0.8678	0.9826	0.9971	0.9989	(86)
MIT	19.7535	19.8964	20.1538	20.4990	20.7889	20.9493	20.9898	20.9827	20.8621	20.4766	20.0541	19.7306	(87)
Th 2	19.9805	19.9828	19.9851	19.9958	19.9979	20.0073	20.0073	20.0090	20.0036	19.9979	19.9938	19.9895	(88)
util rest of house	0.9981	0.9957	0.9872	0.9515	0.8424	0.6327	0.4337	0.4932	0.8019	0.9736	0.9959	0.9986	(89)
MIT 2	18.3130	18.5233	18.8993	19.4003	19.7879	19.9730	20.0034	20.0017	19.8889	19.3772	18.7621	18.2858	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.5564	18.7553	19.1113	19.5860	19.9571	20.1380	20.1701	20.1675	20.0534	19.5630	18.9805	18.5300	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5564	18.7553	19.1113	19.5860	19.9571	20.1380	20.1701	20.1675	20.0534	19.5630	18.9805	18.5300	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9970	0.9938	0.9830	0.9443	0.8403	0.6453	0.4536	0.5135	0.8058	0.9681	0.9940	0.9977	(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	1376.0915	1333.9687	1211.1532	1014.1491	781.8815	518.9417	334.5417	352.3487	560.1308	848.7290	1130.0856	1369.5100	(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	668.4341	529.9869	440.5983	240.9880	94.9338	0.0000	0.0000	0.0000	0.0000	257.0805	480.2026	681.9350	(98)
Space heating												3394.1592	(98)
Space heating per m2												39.5590	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3634.0035 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	668.4341	529.9869	440.5983	240.9880	94.9338	0.0000	0.0000	0.0000	0.0000	257.0805	480.2026	681.9350 (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)	715.6682	567.4378	471.7327	258.0172	101.6422	0.0000	0.0000	0.0000	0.0000	275.2468	514.1356	730.1231 (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	87.7977	87.5874	87.1060	85.9588	83.7484	80.3000	80.3000	80.3000	80.3000	86.0017	87.3143	80.3000 (216)
Fuel for water heating, kWh/month	234.7157	207.4419	217.4597	195.4499	194.2244	178.4080	170.9285	190.5452	192.6496	204.8262	214.9122	228.9216 (219)
Water heating fuel used												2430.4830 (219)
Annual totals kWh/year												
Space heating fuel - main system												3634.0035 (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)												382.9671 (232)
Total delivered energy for all uses												6522.4536 (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	3634.0035	0.2160	784.9447 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2430.4830	0.2160	524.9843 (264)
Space and water heating			1309.9291 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	382.9671	0.5190	198.7599 (268)
Total CO2, kg/m2/year			1547.6140 (272)
Emissions per m2 for space and water heating			15.2672 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3165 (272b)
Emissions per m2 for pumps and fans			0.4537 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2672 * 1.00) + 2.3165 + 0.4537, rounded to 2 d.p.			18.0400 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.4500
Infiltration rate					0.3610 (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) =	0.3068 (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	0.3912	0.3835	0.3759	0.3375	0.3298	0.2915	0.2915	0.2838	0.3068	0.3298	0.3452	0.3605 (22b)
Effective ac	0.5765	0.5736	0.5706	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650 (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)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =		50.8440		(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) = 20160.7505 (34)
234.9738 (35)
7.5500 (36)
(33) + (36) = 58.3941 (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	41.2172	41.0047	40.7965	39.8185	39.6355	38.7836	38.7836	38.6259	39.1117	39.6355	40.0057	40.3927 (38)
Heat transfer coeff	99.6112	99.3988	99.1906	98.2125	98.0295	97.1777	97.1777	97.0199	97.5058	98.0295	98.3997	98.7867 (39)
Average = Sum(39)m / 12 =												98.2116 (39)
HLP	1.1610	1.1585	1.1561	1.1447	1.1425	1.1326	1.1326	1.1308	1.1364	1.1425	1.1468	1.1514 (40)
HLP (average)												1.1447 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m												1496.1255 (45)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.6852	19.2606	15.6638	11.8585	8.8643	7.4837	8.0864	10.5110	14.1078	17.9131	20.9072	22.2879	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.5809	357.1510	344.5950	323.9595	302.1500	281.8809	269.2059	273.1776	284.2203	304.9946	328.8628	347.5874	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				1.3000	10.6334	0.4500	0.0000	0.7700		4.7898 (74)		
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	85.4332	166.9092	275.3552	403.8883	498.0172	511.3860	486.1969	415.4289	320.8605	198.0865	106.4617	70.3102 (83)
Total gains	444.0142	524.0602	619.9502	727.8478	800.1672	793.2669	755.4029	688.6065	605.0808	503.0811	435.3245	417.8976 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2207	56.3408	56.4591	57.0213	57.1278	57.6285	57.6285	57.7222	57.4346	57.1278	56.9129	56.6899	
alpha	4.7480	4.7561	4.7639	4.8014	4.8085	4.8419	4.8419	4.8481	4.8290	4.8085	4.7942	4.7793	
util living area	0.9986	0.9967	0.9896	0.9609	0.8771	0.7153	0.5498	0.6179	0.8692	0.9827	0.9972	0.9990	(86)
MIT	19.6008	19.7632	20.0533	20.4375	20.7585	20.9371	20.9859	20.9760	20.8308	20.3957	19.9264	19.5729	(87)
Th 2	19.9514	19.9533	19.9553	19.9645	19.9662	19.9743	19.9743	19.9758	19.9712	19.9662	19.9628	19.9591	(88)
util rest of house	0.9982	0.9956	0.9860	0.9466	0.8330	0.6258	0.4297	0.4946	0.8047	0.9742	0.9961	0.9986	(89)
MIT 2	18.6717	18.8352	19.1249	19.5070	19.8008	19.9445	19.9705	19.9685	19.8726	19.4736	19.0060	18.6500	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.8287	18.9920	19.2818	19.6643	19.9626	20.1123	20.1421	20.1388	20.0345	19.6294	19.1615	18.8060	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8287	18.9920	19.2818	19.6643	19.9626	20.1123	20.1421	20.1388	20.0345	19.6294	19.1615	18.8060	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	442.8861	520.9935	609.2918	685.1825	666.4158	506.7661	340.0026	354.8753	489.7724	488.1710	433.0682	417.1017	(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	1447.2231	1400.7316	1267.8370	1057.1848	809.9816	535.6696	344.2130	362.7344	578.6531	885.1500	1186.8487	1442.8743	(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	747.2267	591.1840	489.9576	267.8417	106.8129	0.0000	0.0000	0.0000	0.0000	295.3524	542.7219	763.1748	(98)
Space heating												3804.2721	(98)
Space heating per m2												(98) / (4) =	44.3388 (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	913.4702	719.1149	737.3515	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8724	0.9283	0.9005	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	796.9225	667.5438	664.0005	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1023.7863	977.5505	901.2619	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	163.3420	230.6450	176.5225	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												570.5095 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.8355	57.6613	44.1306	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												142.6274 (107)
Space cooling per m2												1.6623 (108)
Energy for space heating												44.3388 (99)
Energy for space cooling												1.6623 (108)
Total												46.0012 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3885 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3302 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880 (22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			13.1500	1.3258	17.4337		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	15.1500	79.7900	0.1800	14.3622		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9499		(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) =	54.4419 (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	96.5244	96.2783	96.0372	94.9044	94.6925	93.7059	93.7059	93.5232	94.0859	94.6925	95.1212	95.5695 (39)
Average = Sum(39)m / 12 =												94.9034 (39)
HLP	Jan 1.1250	Feb 1.1221	Mar 1.1193	Apr 1.1061	May 1.1036	Jun 1.0921	Jul 1.0921	Aug 1.0900	Sep 1.0966	Oct 1.1036	Nov 1.1086	Dec 1.1139 (40)
HLP (average)												1.1061 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)											Total = Sum(45)m =	1496.1255 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.6852	19.2606	15.6638	11.8585	8.8643	7.4837	8.0864	10.5110	14.1078	17.9131	20.9072	22.2879	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.5809	357.1510	344.5950	323.9595	302.1500	281.8809	269.2059	273.1776	284.2203	304.9946	328.8628	347.5874	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.3000	10.6334		0.6300	0.7000		0.7700		4.2246 (74)	
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	75.3521	147.2139	242.8633	356.2295	439.2511	451.0425	428.8257	366.4083	282.9990	174.7123	93.8992	62.0136	(83)
Total gains	433.9330	504.3649	587.4583	680.1890	741.4012	732.9234	698.0316	639.5859	567.2193	479.7069	422.7621	409.6010	(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	61.7288	61.8865	62.0419	62.7825	62.9230	63.5855	63.5855	63.7097	63.3286	62.9230	62.6394	62.3456	
alpha	5.1153	5.1258	5.1361	5.1855	5.1949	5.2390	5.2390	5.2473	5.2219	5.1949	5.1760	5.1564	
util living area	0.9991	0.9979	0.9931	0.9719	0.9014	0.7454	0.5747	0.6426	0.8902	0.9876	0.9981	0.9993	(86)
MIT	19.7042	19.8483	20.1093	20.4624	20.7656	20.9409	20.9877	20.9788	20.8405	20.4359	20.0072	19.6819	(87)
Th 2	19.9805	19.9828	19.9851	19.9958	19.9979	20.0073	20.0073	20.0090	20.0036	19.9979	19.9938	19.9895	(88)
util rest of house	0.9988	0.9971	0.9905	0.9607	0.8619	0.6571	0.4532	0.5189	0.8303	0.9810	0.9974	0.9991	(89)
MIT 2	18.7928	18.9385	19.2000	19.5549	19.8359	19.9795	20.0040	20.0027	19.9103	19.5350	19.1061	18.7778	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.9468	19.0922	19.3537	19.7083	19.9930	20.1420	20.1703	20.1677	20.0675	19.6872	19.2584	18.9306	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9468	19.0922	19.3537	19.7083	19.9930	20.1420	20.1703	20.1677	20.0675	19.6872	19.2584	18.9306	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	433.2175	502.4371	580.5935	650.6365	638.8553	491.1367	330.8230	345.2627	473.6066	469.2260	421.2926	409.1015	(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	1413.7726	1366.4050	1234.4349	1025.7518	785.2854	519.3136	334.5567	352.3642	561.4569	860.4913	1156.5227	1407.7928	(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	729.5329	580.5864	486.4580	270.0830	108.9440	0.0000	0.0000	0.0000	0.0000	291.1014	529.3657	743.0263	(98)
Space heating												3739.0977	(98)
Space heating per m2												43.5792	(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	880.8357	693.4238	710.7765	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8710	0.9300	0.9026	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	767.1735	644.8559	641.5561	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	953.2549	910.4933	843.9651	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	133.9786	197.6342	150.5923	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												482.2050	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.4947	49.4085	37.6481	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.5513 (107)
Space cooling per m2												1.4050 (108)
Energy for space heating												43.5792 (99)
Energy for space cooling												1.4050 (108)
Total												44.9843 (109)
Target Fabric Energy Efficiency (TFEE)												51.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	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												4.4500
Infiltration rate												0.2225 (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) =	0.1891 (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												
	0.2222	0.2080	0.2080	0.1891	0.1939	0.1844	0.1844	0.1797	0.1797	0.1939	0.1891	0.1939 (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)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =	50.8440			(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) =	20160.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							234.9738 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	58.3941 (37)

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

(38)m	Jan 35.7464	Feb 35.7464	Mar 35.7464	Apr 35.7464	May 35.7464	Jun 35.7464	Jul 35.7464	Aug 35.7464	Sep 35.7464	Oct 35.7464	Nov 35.7464	Dec 35.7464 (38)
Heat transfer coeff	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405 (39)
Average = Sum(39)m / 12 =												94.1405 (39)
HLP	Jan 1.0972	Feb 1.0972	Mar 1.0972	Apr 1.0972	May 1.0972	Jun 1.0972	Jul 1.0972	Aug 1.0972	Sep 1.0972	Oct 1.0972	Nov 1.0972	Dec 1.0972 (40)
HLP (average)												1.0972 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan 104.5983	Feb 100.7947	Mar 96.9911	Apr 93.1875	May 89.3840	Jun 85.5804	Jul 85.5804	Aug 89.3840	Sep 93.1875	Oct 96.9911	Nov 100.7947	Dec 104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	1496.1255 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
RHI water heating demand	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)
Heat gains from water heating, kWh/month												
	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	54.2130	48.1515	39.1594	29.6462	22.1609	18.7091	20.2159	26.2774	35.2694	44.7827	52.2680	55.7197 (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	580.4830	575.8007	553.2147	518.2811	482.5172	450.5999	432.0596	440.7277	460.9412	496.0919	535.0831	564.5770 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.3000	13.4684	0.4500	0.0000	0.7700	6.0668 (74)			
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	109.4289	181.9902	304.9718	447.0312	516.7264	586.1759	535.8155	479.1386	371.3848	232.9385	135.9447	85.2269 (83)
Total gains	689.9118	757.7910	858.1865	965.3124	999.2436	1036.7758	967.8751	919.8663	832.3259	729.0305	671.0278	649.8039 (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	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878
alpha	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659
util living area	0.9867	0.9784	0.9475	0.8567	0.6913	0.4576	0.3202	0.3266	0.6077	0.8846	0.9718	0.9894 (86)
MIT	20.1072	20.2214	20.4795	20.7689	20.9385	20.9934	20.9991	20.9991	20.9751	20.7760	20.4018	20.0742 (87)
Th 2	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031 (88)
util rest of house	0.9825	0.9718	0.9317	0.8176	0.6213	0.3708	0.2239	0.2254	0.5107	0.8407	0.9613	0.9859 (89)
MIT 2	19.2160	19.3276	19.5758	19.8370	19.9694	20.0010	20.0030	20.0030	19.9935	19.8509	19.5057	19.1837 (90)
Living area fraction	19.3666	19.4787	19.7285	19.9945	20.1332	20.1687	20.1713	20.1713	20.1594	20.0073	19.6572	0.1690 (91)
MIT	19.3666	19.4787	19.7285	19.9945	20.1332	20.1687	20.1713	20.1713	20.1594	20.0073	19.6572	19.3342 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2166	19.3287	19.5785	19.8445	19.9832	20.0187	20.0213	20.0213	20.0094	19.8573	19.5072	19.1842 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	674.8426	731.9852	792.4544	782.3660	619.3099	385.8973	218.4278	209.0143	425.5784	607.3458	640.4956	638.1841 (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	1281.8720	1254.7670	1127.6644	917.3511	647.9840	387.7390	218.5323	209.1175	433.9294	730.2726	1026.8063	1269.4084 (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	451.6298	351.3094	249.3963	97.1893	21.3335	0.0000	0.0000	0.0000	0.0000	91.4575	278.1437	469.6309 (98)
Space heating												2010.0904 (98)
RHI space heating demand												2010 (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					4.4500
Infiltration rate					0.2225 (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) =		0.1891 (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	0.2411	0.2364	0.2317	0.2080	0.2033	0.1797	0.1797	0.1749	0.1891	0.2033	0.2128	0.2222 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =	50.8440			(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) =	20160.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							234.9738 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	58.3941 (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	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405 (39)
Average = Sum(39)m / 12 =												94.1405 (39)
HLP	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972 (40)
HLP (average)												1.0972 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2130	48.1515	39.1594	29.6462	22.1609	18.7091	20.2159	26.2774	35.2694	44.7827	52.2680	55.7197	(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	580.4830	575.8007	553.2147	518.2811	482.5172	450.5999	432.0596	440.7277	460.9412	496.0919	535.0831	564.5770	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North				1.3000	10.6334	0.4500	0.0000	0.7700			4.7898 (74)	
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	85.4332	166.9092	275.3552	403.8883	498.0172	511.3860	486.1969	415.4289	320.8605	198.0865	106.4617	70.3102 (83)
Total gains	665.9162	742.7099	828.5699	922.1694	980.5343	961.9859	918.2565	856.1565	781.8016	694.1784	641.5448	634.8873 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878
alpha	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659
util living area	0.9919	0.9850	0.9653	0.9069	0.7820	0.6019	0.4463	0.4972	0.7472	0.9395	0.9850	0.9935 (86)
MIT	19.9416	20.0898	20.3438	20.6485	20.8738	20.9727	20.9949	20.9914	20.9240	20.6205	20.2145	19.8962 (87)
Th 2	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031 (88)
util rest of house	0.9894	0.9806	0.9549	0.8799	0.7264	0.5180	0.3477	0.3938	0.6674	0.9157	0.9797	0.9916 (89)
MIT 2	19.0518	19.1980	19.4459	19.7317	19.9226	19.9911	20.0018	20.0007	19.9637	19.7134	19.3226	19.0069 (90)
Living area fraction	19.2022	19.3487	19.5977	19.8866	20.0833	20.1570	20.1696	20.1681	20.1260	19.8667	19.4733	19.1572 (92)
MIT	19.0522	19.1987	19.4477	19.7366	19.9333	20.0070	20.0196	20.0181	19.9760	19.7167	19.3233	19.0072 (93)
Temperature adjustment												-0.1500
adjusted MIT	19.0522	19.1987	19.4477	19.7366	19.9333	20.0070	20.0196	20.0181	19.9760	19.7167	19.3233	19.0072 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9863	0.9759	0.9477	0.8715	0.7221	0.5183	0.3493	0.3954	0.6650	0.9072	0.9749	0.9889 (94)
Useful gains	656.7936	724.8215	785.2118	803.6269	708.0837	498.6234	320.7769	338.4952	519.9189	629.7296	625.4532	627.8625 (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	1388.7807	1346.0875	1218.8986	1020.1644	775.0885	509.0164	321.9267	340.6134	553.1704	858.2502	1150.7120	1393.9533 (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	544.5984	417.4907	322.6630	155.9070	49.8515	0.0000	0.0000	0.0000	0.0000	170.0193	378.1864	569.9716 (98)
Space heating												2608.6880 (98)
Space heating per m2												(98) / (4) = 30.4043 (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												2882.5282	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.5984	417.4907	322.6630	155.9070	49.8515	0.0000	0.0000	0.0000	0.0000	170.0193	378.1864	569.9716	(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)	601.7662	461.3157	356.5337	172.2729	55.0846	0.0000	0.0000	0.0000	0.0000	187.8667	417.8855	629.8029	(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	89.7203	89.6383	89.4404	88.9826	88.1587	87.3000	87.3000	87.3000	87.3000	89.0219	89.5589	87.3000	(216)
(217)m	89.7203	89.6383	89.4404	88.9826	88.1587	87.3000	87.3000	87.3000	87.3000	89.0219	89.5589	89.7636	(217)
Fuel for water heating, kWh/month	188.6363	165.5727	172.2680	152.4306	148.7301	131.2463	123.2459	139.1132	140.0895	158.1408	169.6970	183.0796	(219)
Water heating fuel used												1872.2497	(219)
Annual totals kWh/year													
Space heating fuel - main system												2882.5282	(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)												382.9671	(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												4835.0049	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2882.5282	3.4800	100.3120 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1872.2497	3.4800	65.1543 (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	382.9671	13.1900	50.5134 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-435.7701	13.1900	-57.4781 (252)
Total energy cost			296.0482 (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] = 0.9506 (257)
SAP value	86.7389
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	2882.5282	0.2160	622.6261 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1872.2497	0.2160	404.4059 (264)
Space and water heating			1027.0320 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	382.9671	0.5190	198.7599 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total kg/year			1068.6699 (272)
CO2 emissions per m2			12.4600 (273)
EI value			89.0519
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												4.4500
Infiltration rate												0.2225 (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) =	0.1891 (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												
	0.2222	0.2080	0.2080	0.1891	0.1939	0.1844	0.1844	0.1797	0.1797	0.1939	0.1891	0.1939 (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)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =	50.8440			(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) =	20160.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							234.9738 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	58.3941 (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	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405 (39)
Average = Sum(39)m / 12 =												94.1405 (39)
HLP	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972 (40)
HLP (average)												1.0972 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m =											1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2130	48.1515	39.1594	29.6462	22.1609	18.7091	20.2159	26.2774	35.2694	44.7827	52.2680	55.7197 (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	580.4830	575.8007	553.2147	518.2811	482.5172	450.5999	432.0596	440.7277	460.9412	496.0919	535.0831	564.5770 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				1.3000	13.4684		0.4500	0.0000	0.7700		6.0668 (74)	
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	109.4289	181.9902	304.9718	447.0312	516.7264	586.1759	535.8155	479.1386	371.3848	232.9385	135.9447	85.2269 (83)
Total gains	689.9118	757.7910	858.1865	965.3124	999.2436	1036.7758	967.8751	919.8663	832.3259	729.0305	671.0278	649.8039 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	
alpha	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	
util living area	0.9867	0.9784	0.9475	0.8567	0.6913	0.4576	0.3202	0.3266	0.6077	0.8846	0.9718	0.9894 (86)	
MIT	20.1072	20.2214	20.4795	20.7689	20.9385	20.9934	20.9991	20.9991	20.9751	20.7760	20.4018	20.0742 (87)	
Th 2	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031 (88)	
util rest of house	0.9825	0.9718	0.9317	0.8176	0.6213	0.3708	0.2239	0.2254	0.5107	0.8407	0.9613	0.9859 (89)	
MIT 2	19.2160	19.3276	19.5758	19.8370	19.9694	20.0010	20.0030	20.0030	19.9935	19.8509	19.5057	19.1837 (90)	
Living area fraction	fLA = Living area / (4) =												0.1690 (91)
MIT	19.3666	19.4787	19.7285	19.9945	20.1332	20.1687	20.1713	20.1713	20.1594	20.0073	19.6572	19.3342 (92)	
Temperature adjustment													-0.1500
adjusted MIT	19.2166	19.3287	19.5785	19.8445	19.9832	20.0187	20.0213	20.0213	20.0094	19.8573	19.5072	19.1842 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9782	0.9659	0.9234	0.8105	0.6198	0.3722	0.2257	0.2272	0.5113	0.8331	0.9545	0.9821 (94)
Useful gains	674.8426	731.9852	792.4544	782.3660	619.3099	385.8973	218.4278	209.0143	425.5784	607.3458	640.4956	638.1841 (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	1281.8720	1254.7670	1127.6644	917.3511	647.9840	387.7390	218.5323	209.1175	433.9294	730.2726	1026.8063	1269.4084 (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	451.6298	351.3094	249.3963	97.1893	21.3335	0.0000	0.0000	0.0000	0.0000	91.4575	278.1437	469.6309 (98)
Space heating												2010.0904 (98)
Space heating per m2										(98) / (4) =		23.4276 (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													2221.0943 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	451.6298	351.3094	249.3963	97.1893	21.3335	0.0000	0.0000	0.0000	0.0000	91.4575	278.1437	469.6309	(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)	499.0385	388.1872	275.5760	107.3915	23.5729	0.0000	0.0000	0.0000	0.0000	101.0580	307.3411	518.9292	(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	89.6047	89.5254	89.2507	88.6079	87.7341	87.3000	87.3000	87.3000	87.3000	88.5328	89.3429	87.3000	(216)
(217)m	89.6047	89.5254	89.2507	88.6079	87.7341	87.3000	87.3000	87.3000	87.3000	88.5328	89.3429	89.6482	(217)
Fuel for water heating, kWh/month	188.8797	165.7815	172.6342	153.0751	149.4498	131.2463	123.2459	139.1132	140.0895	159.0145	170.1074	183.3153	(219)
Water heating fuel used	188.8797	165.7815	172.6342	153.0751	149.4498	131.2463	123.2459	139.1132	140.0895	159.0145	170.1074	1875.9523	(219)
Annual totals kWh/year													
Space heating fuel - main system												2221.0943	(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)												382.9671	(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												4118.6153	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2221.0943	10.2300	227.2179 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1875.9523	10.2300	191.9099 (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	382.9671	36.7200	140.6255 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.4285	36.7200	-181.5542 (252)
Total energy cost			530.0479 (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	2221.0943	0.2160	479.7564 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1875.9523	0.2160	405.2057 (264)
Space and water heating			884.9621 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	382.9671	0.5190	198.7599 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	0.5190	-256.6084 (269)
Total kg/year			896.1562 (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	2221.0943	1.2200	2709.7351 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1875.9523	1.2200	2288.6618 (264)
Space and water heating			4998.3969 (265)
Pumps and fans	133.0300	3.0700	408.4023 (267)
Energy for lighting	382.9671	3.0700	1175.7090 (268)
Energy saving/generation technologies			

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PV Unit	-494.4285	3.0700	-1517.8956 (269)
Primary energy kWh/year			5064.6126 (272)
Primary energy kWh/m2/year			59.0281 (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 (21.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£83 2.20 kg/m²	B 88	B 91
Total Savings	£83 2.20 kg/m²		
Potential energy efficiency rating:		B 88	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 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	£189	£208	-£19
Mains gas	£522	£421	£102
Space heating	£379	£379	£0
Water heating	£192	£109	£83
Lighting	£141	£141	£0
Generated (PV)	-£182	-£182	£0
Total cost of fuels	£529	£447	£84
Total cost of uses	£530	£447	£83
Delivered energy	48 kWh/m²	37 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	47 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.4500
Infiltration rate					0.2225 (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)	=	0.1891 (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	0.2411	0.2364	0.2317	0.2080	0.2033	0.1797	0.1797	0.1749	0.1891	0.2033	0.2128	0.2222 (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)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =	50.8440			(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) =	20160.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							234.9738 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	58.3941 (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	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405 (39)
Average = Sum(39)m / 12 =												94.1405 (39)
HLP	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972 (40)
HLP (average)												1.0972 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2122 (H8)
Utilisation factor												0.5617 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-853.2830 (H17)
Solar input	-24.7435	-41.2898	-70.3213	-94.2443	-116.4309	-114.4702	-112.9574	-98.6914	-77.2952	-52.7835	-29.3494	-20.7061 (63)
Solar input (sum of months) = Sum (63)m =												-853.2830 (63)
Output from w/h	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328 (64)
Total per year (kWh/year) = Sum (64)m =												813.5878 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2130	48.1515	39.1594	29.6462	22.1609	18.7091	20.2159	26.2774	35.2694	44.7827	52.2680	55.7197	(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	580.4830	575.8007	553.2147	518.2811	482.5172	450.5999	432.0596	440.7277	460.9412	496.0919	535.0831	564.5770	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.3000	10.6334		0.4500		0.0000		0.7700		4.7898 (74)	
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	85.4332	166.9092	275.3552	403.8883	498.0172	511.3860	486.1969	415.4289	320.8605	198.0865	106.4617	70.3102	(83)	
Total gains	665.9162	742.7099	828.5699	922.1694	980.5343	961.9859	918.2565	856.1565	781.8016	694.1784	641.5448	634.8873	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	
alpha	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	
util living area	0.9919	0.9850	0.9653	0.9069	0.7820	0.6019	0.4463	0.4972	0.7472	0.9395	0.9850	0.9935	(86)
MIT	19.9416	20.0898	20.3438	20.6485	20.8738	20.9727	20.9949	20.9914	20.9240	20.6205	20.2145	19.8962	(87)
Th 2	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	(88)
util rest of house	0.9894	0.9806	0.9549	0.8799	0.7264	0.5180	0.3477	0.3938	0.6674	0.9157	0.9797	0.9916	(89)
MIT 2	19.0518	19.1980	19.4459	19.7317	19.9226	19.9911	20.0018	20.0007	19.9637	19.7134	19.3226	19.0069	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	19.2022	19.3487	19.5977	19.8866	20.0833	20.1570	20.1696	20.1681	20.1260	19.8667	19.4733	19.1572	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0522	19.1987	19.4477	19.7366	19.9333	20.0070	20.0196	20.0181	19.9760	19.7167	19.3233	19.0072	(93)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9759	0.9477	0.8715	0.7221	0.5183	0.3493	0.3954	0.6650	0.9072	0.9749	0.9889	(94)
Useful gains	656.7936	724.8215	785.2118	803.6269	708.0837	498.6234	320.7769	338.4952	519.9189	629.7296	625.4532	627.8625	(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	1388.7807	1346.0875	1218.8986	1020.1644	775.0885	509.0164	321.9267	340.6134	553.1704	858.2502	1150.7120	1393.9533	(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	544.5984	417.4907	322.6630	155.9070	49.8515	0.0000	0.0000	0.0000	0.0000	170.0193	378.1864	569.9716	(98)
Space heating												2608.6880	(98)
Space heating per m2											(98) / (4) =	30.4043	(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													2882.5282	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	544.5984	417.4907	322.6630	155.9070	49.8515	0.0000	0.0000	0.0000	0.0000	170.0193	378.1864	569.9716	(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)	601.7662	461.3157	356.5337	172.2729	55.0846	0.0000	0.0000	0.0000	0.0000	187.8667	417.8855	629.8029	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328	(64)	
Efficiency of water heater	89.8097	89.8276	89.8215	89.8094	89.7513	87.3000	87.3000	87.3000	87.3000	89.3826	89.6950	89.8372	(216)	
Fuel for water heating, kWh/month	160.8975	119.2581	93.2471	46.0890	16.3647	0.1235	0.0000	26.0645	51.5497	98.4492	136.7183	159.8812	(219)	
Water heating fuel used												908.6430	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2882.5282	(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)													382.9671	(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													3921.3982	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2882.5282	3.4800	100.3120	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	908.6430	3.4800	31.6208	(247)
Mechanical ventilation fans	58.0300	13.1900	7.6542	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	382.9671	13.1900	50.5134	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-435.7701	13.1900	-57.4781	(252)
Total energy cost			269.1097	(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] =	0.8641	(257)
SAP value		87.9456	
SAP rating (Section 12)		88	(258)
SAP band		B	

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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	2882.5282	0.2160	622.6261 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	908.6430	0.2160	196.2669 (264)
Space and water heating			818.8930 (265)
Pumps and fans	183.0300	0.5190	94.9926 (267)
Energy for lighting	382.9671	0.5190	198.7599 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total kg/year			886.4808 (272)
CO2 emissions per m2			10.3300 (273)
EI value			90.9183
EI rating			91 (274)
EI band			B

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Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								0.0000 / (5) =	0.0000 (8)			
Pressure test								Yes				
Measured/design AP50								4.4500				
Infiltration rate								0.2225	(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) =	0.1891 (21)			
Wind speed	Jan 4.7000	Feb 4.4000	Mar 4.4000	Apr 4.0000	May 4.1000	Jun 3.9000	Jul 3.9000	Aug 3.8000	Sep 3.8000	Oct 4.1000	Nov 4.0000	Dec 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	0.2222	0.2080	0.2080	0.1891	0.1939	0.1844	0.1844	0.1797	0.1797	0.1939	0.1891	0.1939 (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)			13.1500	1.3258	17.4337		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	15.1500	79.7900	0.2700	21.5433	150.0000	11968.5004 (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) =	50.8440			(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) =	20160.7505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							234.9738 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	58.3941 (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	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405	94.1405 (39)
Average = Sum(39)m / 12 =												94.1405 (39)
HLP	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972	1.0972 (40)
HLP (average)												1.0972 (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 content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3542 (H8)
Utilisation factor												0.5221 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-886.0488 (H17)
Solar input	-28.9129	-41.1174	-71.3493	-95.9768	-111.5315	-121.3139	-115.0241	-104.8908	-82.0978	-56.7431	-34.1974	-22.8937 (63)
Solar input (sum of months) = Sum (63)m =												-886.0488 (63)
Output from w/h	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452 (64)
Total per year (kWh/year) = Sum (64)m =												789.6247 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2130	48.1515	39.1594	29.6462	22.1609	18.7091	20.2159	26.2774	35.2694	44.7827	52.2680	55.7197	(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	580.4830	575.8007	553.2147	518.2811	482.5172	450.5999	432.0596	440.7277	460.9412	496.0919	535.0831	564.5770	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North				1.3000	13.4684		0.4500	0.0000	0.7700	6.0668 (74)		
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	109.4289	181.9902	304.9718	447.0312	516.7264	586.1759	535.8155	479.1386	371.3848	232.9385	135.9447	85.2269 (83)
Total gains	689.9118	757.7910	858.1865	965.3124	999.2436	1036.7758	967.8751	919.8663	832.3259	729.0305	671.0278	649.8039 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878	59.4878
alpha	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659	4.9659
util living area	0.9867	0.9784	0.9475	0.8567	0.6913	0.4576	0.3202	0.3266	0.6077	0.8846	0.9718	0.9894 (86)
MIT	20.1072	20.2214	20.4795	20.7689	20.9385	20.9934	20.9991	20.9991	20.9751	20.7760	20.4018	20.0742 (87)
Th 2	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031	20.0031 (88)
util rest of house	0.9825	0.9718	0.9317	0.8176	0.6213	0.3708	0.2239	0.2254	0.5107	0.8407	0.9613	0.9859 (89)
MIT 2	19.2160	19.3276	19.5758	19.8370	19.9694	20.0010	20.0030	20.0030	19.9935	19.8509	19.5057	19.1837 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.3666	19.4787	19.7285	19.9945	20.1332	20.1687	20.1713	20.1713	20.1594	20.0073	19.6572	19.3342 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2166	19.3287	19.5785	19.8445	19.9832	20.0187	20.0213	20.0213	20.0094	19.8573	19.5072	19.1842 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9782	0.9659	0.9234	0.8105	0.6198	0.3722	0.2257	0.2272	0.5113	0.8331	0.9545	0.9821	(94)
Useful gains	674.8426	731.9852	792.4544	782.3660	619.3099	385.8973	218.4278	209.0143	425.5784	607.3458	640.4956	638.1841	(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	1281.8720	1254.7670	1127.6644	917.3511	647.9840	387.7390	218.5323	209.1175	433.9294	730.2726	1026.8063	1269.4084	(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	451.6298	351.3094	249.3963	97.1893	21.3335	0.0000	0.0000	0.0000	0.0000	91.4575	278.1437	469.6309	(98)
Space heating												2010.0904	(98)
Space heating per m2										(98) / (4) =		23.4276	(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													2221.0943	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	451.6298	351.3094	249.3963	97.1893	21.3335	0.0000	0.0000	0.0000	0.0000	91.4575	278.1437	469.6309	(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)	499.0385	388.1872	275.5760	107.3915	23.5729	0.0000	0.0000	0.0000	0.0000	101.0580	307.3411	518.9292	(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	89.7204	89.7305	89.6812	89.5487	88.9395	87.3000	87.3000	87.3000	87.3000	88.9389	89.5238	87.3000	(216)	
(217)m	89.7204	89.7305	89.6812	89.5487	88.9395	87.3000	87.3000	87.3000	87.3000	88.9389	89.5238	87.3000	(217)	
Fuel for water heating, kWh/month	156.4106	119.5794	92.2467	44.2885	22.0228	0.0000	0.0000	18.9633	46.0484	94.4884	131.5644	157.6191	(219)	
Water heating fuel used												883.2315	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2221.0943	(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)													382.9671	(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													3175.8944	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2221.0943	10.2300	227.2179	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	883.2315	10.2300	90.3546	(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	382.9671	36.7200	140.6255	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.4285	36.7200	-181.5542	(252)
Total energy cost			446.8525	(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	2221.0943	0.2160	479.7564	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	883.2315	0.2160	190.7780	(264)
Space and water heating			670.5344	(265)
Pumps and fans	183.0300	0.5190	94.9926	(267)

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Energy for lighting	382.9671	0.5190	198.7599 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	0.5190	-256.6084 (269)
Total kg/year			707.6785 (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	2221.0943	1.2200	2709.7351 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	883.2315	1.2200	1077.5424 (264)
Space and water heating			3787.2775 (265)
Pumps and fans	183.0300	3.0700	561.9023 (267)
Energy for lighting	382.9671	3.0700	1175.7090 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	3.0700	-1517.8956 (269)
Primary energy kWh/year			4006.9931 (272)
Primary energy kWh/m2/year			46.7016 (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	235.0 (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	58.39 (37)
Summer heat loss coefficient	344.37 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.3000	87.1704	0.4500	0.0000	0.9000	45.8952
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:						647.1538

	Jun	Jul	Aug	
Solar gains	697	647	566	(P4)
Internal gains	448	429	438	
Total summer gains	1145	1076	1004	(P5)
Summer gain/loss ratio	3.32	3.13	2.92	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 235.0)	0.36	0.36	0.36	
Threshold temperature	19.08	20.78	20.57	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 82	Issued on Date	12/10/2023
Assessment Reference	plot 82 way	Prop Type Ref	21809
Property	1 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	14.45
Environmental	89 B	TER	18.04
CO ₂ Emissions (t/year)	0.90	% DER<TER	19.89
General Requirements Compliance	Pass	DFEE	46.00
		TFEE	51.73
		% DFEE<TFEE	11.08
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jpsustainability.co.uk		Assessor ID
			AU36-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.04	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.45	kgCO ₂ /m ²	Pass
	-3.59 (-19.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.73	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.00	kWh/m ² /yr	
	-5.7 (-11.0%)	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	1.35 (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	4.45 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.30 m², No overhang

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

4.45 (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 82	Issued on Date	12/10/2023
Assessment Reference	plot 82 way	Prop Type Ref	21809
Property	1 Wayfaring Close, Southampton, SO30 0AT		

SAP Rating	87 B	DER	14.45	TER	18.04
Environmental	89 B	% DER<TER	19.89		
CO ₂ Emissions (t/year)	0.90	DFEE	46.00	TFEE	51.73
General Requirements Compliance	Pass	% DFEE<TFEE	11.08		

Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jpsustainability.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	234.97	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	79.79

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
party	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	44.95

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

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cd	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	42.90	42.90

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

11.0 Heat Loss Floors

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

11.2 Internal Floors

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

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
entrance	Solid Door	[1] external	East							2.00	
front	Window	[1] external	East	None	0.00					4.35	
rear	Window	[1] external	West	None	0.00					7.50	
side	Window	[1] external	North	None	0.00					1.30	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.90	0.300	No
Independently assessed	E3 Sill	8.30	0.015	No
Independently assessed	E4 Jamb	21.90	0.011	No
Independently assessed	E5 Ground floor (normal)	18.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	18.80	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	7.70	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.10	0.063	No
Independently assessed	E16 Corner (normal)	15.15	0.067	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.05	-0.090	No
Independently assessed	E18 Party wall between dwellings	10.20	0.042	No
Independently assessed	P1 Party wall - Ground floor	8.90	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.90	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.90	0.091	No

Y-value	0.042	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.45	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

Mechanical Ventilation

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

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	23	
Total number of L.E.L. fittings	23	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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

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