

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 27			Issued on Date	22/06/2023
Assessment Reference	27 Hamblewood	Prop Type Ref	21809		
Property	2 Red Oak Road, Southampton, SO30 0AU				
SAP Rating	87 B	DER	14.54	TER	18.48
Environmental	88 B	% DER<TER	21.30		
CO ₂ Emissions (t/year)	1.13	DFEE	56.32	TFEE	61.54
General Requirements Compliance	Pass	% DFEE<TFEE	8.48		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 113 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) 18.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.54 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.32 (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: 4.09 (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 ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North: 0.65 m², No overhang
Windows facing East: 6.95 m², No overhang
Windows facing South: 0.65 m², No overhang
Windows facing West: 8.60 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 1.20 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	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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												4.0900
Infiltration rate												0.2045 (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) =	0.1738 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2216	0.2173	0.2129	0.1912	0.1869	0.1651	0.1651	0.1608	0.1738	0.1869	0.1956	0.2042 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
entrance			4.0000	1.0000	4.0000		(26)					
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)					
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)					
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)					
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)					
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)					
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)					
Total net area of external elements Aum(A, m2)			290.2600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2797		(33)					
stud			176.1000			9.0000	1584.9001 (32c)					
block			13.8000			75.0000	1035.0000 (32c)					
internal			46.2000			18.0000	831.6000 (32d)					
internal			46.2000			9.0000	415.8000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		28813.3011 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							254.9850 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0276 (36)					
Total fabric heat loss						(33) + (36) =	95.3073 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.3336	Feb 47.3336	Mar 47.3336	Apr 47.3336	May 47.3336	Jun 47.3336	Jul 47.3336	Aug 47.3336	Sep 47.3336	Oct 47.3336	Nov 47.3336	Dec 47.3336 (38)
Heat transfer coeff	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409 (39)
Average = Sum(39)m / 12 =												142.6409 (39)
HLP	Jan 1.2623	Feb 1.2623	Mar 1.2623	Apr 1.2623	May 1.2623	Jun 1.2623	Jul 1.2623	Aug 1.2623	Sep 1.2623	Oct 1.2623	Nov 1.2623	Dec 1.2623 (40)
HLP (average)												1.2623 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)												Total = Sum (45)m = 1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (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	14.1538	12.7727	14.1150	13.6235	14.0425	13.5491	13.9755	14.0190	13.5896	14.0811	13.6670	14.1412 (61)
Total heat required for water heating calculated for each month	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (64)
Heat gains from water heating, kWh/month	58.5659	51.3206	53.1919	46.7034	45.0557	39.2375	36.7144	41.6257	41.9737	48.4772	52.4908	56.8265 (65)
												Total per year (kWh/year) = Sum (64)m = 1761.9728 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.0237	23.1141	18.7976	14.2310	10.6378	8.9809	9.7042	12.6139	16.9303	21.4969	25.0901	26.7470 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.7977	278.6596	271.4476	256.0943	236.7134	218.4981	206.3292	203.4673	210.6792	226.0326	245.4135	263.6287 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584 (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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674 (71)
Water heating gains (Table 5)	78.7177	76.3699	71.4945	64.8659	60.5587	54.4965	49.3473	55.9486	58.2968	65.1575	72.9038	76.3797 (72)
Total internal gains	449.0143	446.6188	430.2150	403.6664	376.3852	350.4508	333.8559	340.5050	354.3816	381.1623	411.8826	435.2307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	0.6500	10.6334	0.4500	0.0000	0.7700	2.3949 (74)
East	6.9500	19.6403	0.4500	0.0000	0.7700	47.2972 (76)
South	0.6500	46.7521	0.4500	0.0000	0.7700	10.5297 (78)
West	8.6000	19.6403	0.4500	0.0000	0.7700	58.5260 (80)

Solar gains	118.7479	228.8344	370.6645	534.5315	652.0517	666.6930	635.0102	547.0892	428.8022	269.6864	147.3849	98.1190 (83)
Total gains	567.7622	675.4532	800.8795	938.1980	1028.4369	1017.1438	968.8661	887.5942	783.1838	650.8487	559.2675	533.3498 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108
alpha	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407
util living area	0.9992	0.9979	0.9931	0.9738	0.9125	0.7784	0.6160	0.6834	0.9054	0.9886	0.9982	0.9994 (86)
MIT	19.5444	19.6986	19.9791	20.3485	20.6887	20.9028	20.9753	20.9602	20.7793	20.3262	19.8575	19.5055 (87)
Th 2	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705 (88)
util rest of house	0.9988	0.9971	0.9904	0.9626	0.8732	0.6833	0.4736	0.5417	0.8457	0.9821	0.9974	0.9991 (89)
MIT 2	18.5440	18.6979	18.9770	19.3397	19.6560	19.8249	19.8643	19.8591	19.7415	19.3225	18.8569	18.5051 (90)
Living area fraction	18.6635	18.8175	19.0967	19.4602	19.7793	19.9537	19.9970	19.9906	fLA = Living area / (4) =	19.4424	18.9764	0.1195 (91)
MIT	18.6635	18.8175	19.0967	19.4602	19.7793	19.9537	19.9970	19.9906	19.8655	19.4424	18.9764	18.6246 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5135	18.6675	18.9467	19.3102	19.6293	19.8037	19.8470	19.8406	19.7155	19.2924	18.8264	18.4746 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9983	0.9958	0.9873	0.9550	0.8626	0.6768	0.4704	0.5375	0.8350	0.9771	0.9963	0.9987 (94)
Ext temp.	566.7822	672.6339	790.6803	895.9989	887.1534	688.3830	455.7461	477.0931	653.9283	635.9151	557.1970	532.6624 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2027.4228	1963.8047	1775.4125	1484.9254	1131.0469	742.2589	463.1616	490.7711	801.0000	1239.8972	1672.6645	2036.1403 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1086.7166	867.6667	732.6408	424.0271	181.4568	0.0000	0.0000	0.0000	0.0000	449.3627	803.1366	1118.5875 (98)
Space heating per m2												5663.5948 (98)
												(98) / (4) = 50.1203 (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													6258.1157 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1086.7166	867.6667	732.6408	424.0271	181.4568	0.0000	0.0000	0.0000	0.0000	449.3627	803.1366	1118.5875	(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)	1200.7918	958.7478	809.5478	468.5382	200.5047	0.0000	0.0000	0.0000	0.0000	496.5334	887.4438	1236.0083	(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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155	(64)
Efficiency of water heater (217)m	90.0318	89.9932	89.8988	89.6675	89.0837	87.3000	87.3000	87.3000	87.3000	89.6802	89.9487	90.0547	(216)
Fuel for water heating, kWh/month	199.5405	175.0319	181.8465	160.4169	156.0218	139.0255	130.4545	147.3867	148.4634	166.4691	179.2778	193.6772	(219)
Water heating fuel used												1977.6117	(219)
Annual totals kWh/year													
Space heating fuel - main system												6258.1157	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)													75.7473 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													150.7473 (231)
Electricity for lighting (calculated in Appendix L)													459.5874 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 908 * 1.00) =										-871.5401			-871.5401 (233)
Total delivered energy for all uses													7974.5221 (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	6258.1157	0.2160	1351.7530 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1977.6117	0.2160	427.1641 (264)
Space and water heating			1778.9171 (265)
Pumps and fans	150.7473	0.5190	78.2379 (267)
Energy for lighting	459.5874	0.5190	238.5259 (268)
Energy saving/generation technologies			
PV Unit	-871.5401	0.5190	-452.3293 (269)
Total CO2, kg/year			1643.3515 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5400 (273)

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

DER			14.5400 ZC1
Total Floor Area		TFA	113.0000
Assumed number of occupants		N	2.8317
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.4630 ZC2
CO2 emissions from cooking, equation (L16)			1.6545 ZC3
Total CO2 emissions			30.6575 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			30.6575 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.1394 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.3894 (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) =	0.3310 (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	0.4221	0.4138	0.4055	0.3641	0.3558	0.3145	0.3145	0.3062	0.3310	0.3558	0.3724	0.3889 (22b)
Effective ac	0.5891	0.5856	0.5822	0.5663	0.5633	0.5494	0.5494	0.5469	0.5548	0.5633	0.5693	0.5756 (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			4.0000	1.0000	4.0000		(26)					
TER Opening Type (Uw = 1.40)			16.8500	1.3258	22.3390		(27)					
ground			46.2000	0.1300	6.0060		(28a)					
exposed			19.1000	0.1300	2.4830		(28b)					
external	157.4600	20.8500	136.6100	0.1800	24.5898		(29a)					
cold	55.5000		55.5000	0.1300	7.2150		(30)					
sloped	12.0000		12.0000	0.1300	1.5600		(30)					
Total net area of external elements Aum(A, m2)			290.2600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.1928		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.5105 (36)					
Total fabric heat loss						(33) + (36) =	85.7033 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.7649	Feb 55.4375	Mar 55.1166	Apr 53.6093	May 53.3273	Jun 52.0144	Jul 52.0144	Aug 51.7713	Sep 52.5201	Oct 53.3273	Nov 53.8978	Dec 54.4942 (38)
Heat transfer coeff	141.4683	141.1409	140.8199	139.3126	139.0306	137.7177	137.7177	137.4746	138.2234	139.0306	139.6011	140.1976 (39)
Average = Sum(39)m / 12 =												139.3112 (39)
HLP	Jan 1.2519	Feb 1.2490	Mar 1.2462	Apr 1.2329	May 1.2304	Jun 1.2187	Jul 1.2187	Aug 1.2166	Sep 1.2232	Oct 1.2304	Nov 1.2354	Dec 1.2407 (40)
HLP (average)												1.2328 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Daily hot water use	Jan 111.5977	Feb 107.5396	Mar 103.4815	Apr 99.4234	May 95.3653	Jun 91.3072	Jul 91.3072	Aug 95.3653	Sep 99.4234	Oct 103.4815	Nov 107.5396	Dec 111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)												1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	50.9589	49.0307	48.5971	45.0282	46.5292	48.5971	49.0307	50.9589	49.3151	50.9589 (61)
Solar input	216.4551	190.7715	200.3218	179.2489	173.5446	152.8484	146.4404	163.2467	165.0496	186.1677	196.9061	211.2332 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	216.4551	190.7715	200.3218	179.2489	173.5446	152.8484	146.4404	163.2467	165.0496	186.1677	196.9061	211.2332 (64)
	67.7672	59.6343	62.4029	55.5552	53.6943	47.1073	44.8528	50.2703	50.8340	57.6967	61.4028	66.0309 (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	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.0237	23.1141	18.7976	14.2310	10.6378	8.9809	9.7042	12.6139	16.9303	21.4969	25.0901	26.7470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.7977	278.6596	271.4476	256.0943	236.7134	218.4981	206.3292	203.4673	210.6792	226.0326	245.4135	263.6287	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	(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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	(71)
Water heating gains (Table 5)	91.0850	88.7414	83.8749	77.1601	72.1698	65.4268	60.2860	67.5676	70.6027	77.5493	85.2816	88.7512	(72)
Total internal gains	461.3816	458.9903	442.5954	415.9606	387.9963	361.3811	344.7947	352.1240	366.6875	393.5541	424.2604	447.6023	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				0.6500	10.6334	0.6300		0.7000		0.7700		2.1123 (74)	
East				6.9500	19.6403	0.6300		0.7000		0.7700		41.7161 (76)	
South				0.6500	46.7521	0.6300		0.7000		0.7700		9.2872 (78)	
West				8.6000	19.6403	0.6300		0.7000		0.7700		51.6200 (80)	

Solar gains	104.7356	201.8320	326.9261	471.4568	575.1096	588.0233	560.0790	482.5327	378.2036	237.8634	129.9934	86.5410	(83)
Total gains	566.1172	660.8223	769.5215	887.4174	963.1059	949.4043	904.8737	834.6567	744.8911	631.4174	554.2539	534.1432	(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	55.4698	55.5985	55.7252	56.3282	56.4424	56.9805	56.9805	57.0812	56.7720	56.4424	56.2118	55.9726	
alpha	4.6980	4.7066	4.7150	4.7552	4.7628	4.7987	4.7987	4.8054	4.7848	4.7628	4.7475	4.7315	
util living area	0.9991	0.9979	0.9937	0.9770	0.9232	0.7954	0.6339	0.6972	0.9118	0.9890	0.9981	0.9993	(86)
MIT	19.5338	19.6832	19.9568	20.3297	20.6692	20.8964	20.9734	20.9586	20.7748	20.3271	19.8647	19.5107	(87)
Th 2	19.8787	19.8810	19.8832	19.8938	19.8958	19.9050	19.9050	19.9068	19.9015	19.8958	19.8918	19.8876	(88)
util rest of house	0.9987	0.9971	0.9913	0.9672	0.8880	0.7049	0.4936	0.5594	0.8562	0.9829	0.9973	0.9991	(89)
MIT 2	17.9205	18.1406	18.5412	19.0864	19.5548	19.8313	19.8948	19.8885	19.7043	19.0898	18.4139	17.8929	(90)
Living area fraction	18.1133	18.3249	18.7103	19.2350	19.6880	19.9586	20.0237	20.0163	19.8322	19.2376	18.5872	18.0862	(92)
Temperature adjustment	18.1133	18.3249	18.7103	19.2350	19.6880	19.9586	20.0237	20.0163	19.8322	19.2376	18.5872	18.0862	(93)
adjusted MIT	18.1133	18.3249	18.7103	19.2350	19.6880	19.9586	20.0237	20.0163	19.8322	19.2376	18.5872	18.0862	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9954	0.9874	0.9591	0.8797	0.7100	0.5099	0.5746	0.8516	0.9772	0.9958	0.9984	(94)
Ext temp.	564.9233	657.7902	759.8254	851.0828	847.2461	674.0862	461.3763	479.6153	634.3730	617.0498	551.9094	533.2899	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1954.1379	1894.7992	1719.4518	1439.7894	1110.5707	737.9682	471.4975	497.1522	792.3199	1200.8938	1603.6273	1946.8047	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1033.5756	831.2700	713.9620	423.8688	195.9135	0.0000	0.0000	0.0000	0.0000	434.3799	757.2369	1051.6550	(98)
												5441.8618	(98)
												48.1581	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5826.4045 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1033.5756	831.2700	713.9620	423.8688	195.9135	0.0000	0.0000	0.0000	0.0000	434.3799	757.2369	1051.6550	(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)	1106.6120	890.0107	764.4133	453.8209	209.7575	0.0000	0.0000	0.0000	0.0000	465.0749	810.7462	1125.9690	(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	216.4551	190.7715	200.3218	179.2489	173.5446	152.8484	146.4404	163.2467	165.0496	186.1677	196.9061	211.2332	(64)
Efficiency of water heater (217)m	88.4731	88.3263	87.9755	87.1425	85.3570	80.3000	80.3000	80.3000	80.3000	87.1129	88.1129	88.5374	(216)
Fuel for water heating, kWh/month	244.6565	215.9848	227.7017	205.6965	203.3162	190.3467	182.3666	203.2961	205.5412	213.7086	223.4703	238.5808	(219)
Water heating fuel used												2554.6662	(219)
Annual totals kWh/year													
Space heating fuel - main system												5826.4045	(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)												459.5874	(232)
Total delivered energy for all uses												8915.6580	(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	5826.4045	0.2160	1258.5034	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2554.6662	0.2160	551.8079	(264)
Space and water heating			1810.3113	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	459.5874	0.5190	238.5259	(268)
Total CO2, kg/m2/year			2087.7621	(272)
Emissions per m2 for space and water heating			16.0205	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1108	(272b)
Emissions per m2 for pumps and fans			0.3445	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0205 * 1.00) + 2.1108 + 0.3445, rounded to 2 d.p.			18.4800	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1394 (8)
Pressure test					Yes
Measured/design AP50					4.0900
Infiltration rate					0.3439 (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)	=	0.2923 (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	0.3727	0.3654	0.3581	0.3216	0.3143	0.2777	0.2777	0.2704	0.2923	0.3143	0.3289	0.3435 (22b)
Effective ac	0.5695	0.5668	0.5641	0.5517	0.5494	0.5386	0.5386	0.5366	0.5427	0.5494	0.5541	0.5590 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)
Total net area of external elements Aum(A, m ²)			290.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.2797		(33)
stud			176.1000			9.0000	1584.9001 (32c)
block			13.8000			75.0000	1035.0000 (32c)
internal			46.2000			18.0000	831.6000 (32d)
internal			46.2000			9.0000	415.8000 (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) = 28813.3011 (34)
254.9850 (35)
15.0276 (36)
(33) + (36) = 95.3073 (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	53.9099	53.6545	53.4042	52.2285	52.0085	50.9845	50.9845	50.7949	51.3790	52.0085	52.4535	52.9187 (38)
Heat transfer coeff	149.2172	148.9618	148.7115	147.5358	147.3158	146.2918	146.2918	146.1022	146.6863	147.3158	147.7608	148.2261 (39)
Average = Sum(39)m / 12 =												147.5348 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3205	1.3182	1.3160	1.3056	1.3037	1.2946	1.2946	1.2929	1.2981	1.3037	1.3076	1.3117 (40)
HLP (average)												1.3056 (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
Average daily hot water use (litres/day)
2.8317 (42)
101.4525 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1596.2429 (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	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	35.1680	30.7581	31.7396	27.6714	26.5513	22.9118	21.2311	24.3630	24.6540	28.7319	31.3631	34.0583 (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	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.0237	23.1141	18.7976	14.2310	10.6378	8.9809	9.7042	12.6139	16.9303	21.4969	25.0901	26.7470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.7977	278.6596	271.4476	256.0943	236.7134	218.4981	206.3292	203.4673	210.6792	226.0326	245.4135	263.6287	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	(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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	(71)
Water heating gains (Table 5)	47.2688	45.7710	42.6608	38.4325	35.6873	31.8219	28.5365	32.7460	34.2417	38.6181	43.5598	45.7773	(72)
Total internal gains	414.5654	413.0199	398.3813	374.2330	348.5138	324.7762	310.0451	314.3025	327.3265	351.6229	379.5387	401.6283	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				0.6500	10.6334	0.4500	0.0000		0.7700		2.3949 (74)	
East				6.9500	19.6403	0.4500	0.0000		0.7700		47.2972 (76)	
South				0.6500	46.7521	0.4500	0.0000		0.7700		10.5297 (78)	
West				8.6000	19.6403	0.4500	0.0000		0.7700		58.5260 (80)	
Solar gains	118.7479	228.8344	370.6645	534.5315	652.0517	666.6930	635.0102	547.0892	428.8022	269.6864	147.3849	98.1190 (83)
Total gains	533.3133	641.8543	769.0458	908.7645	1000.5655	991.4693	945.0553	861.3916	756.1287	621.3093	526.9235	499.7473 (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	53.6379	53.7298	53.8203	54.2492	54.3302	54.7105	54.7105	54.7815	54.5634	54.3302	54.1666	53.9965	
alpha	4.5759	4.5820	4.5880	4.6166	4.6220	4.6474	4.6474	4.6521	4.6376	4.6220	4.6111	4.5998	
util living area	0.9993	0.9983	0.9943	0.9778	0.9239	0.7986	0.6399	0.7085	0.9189	0.9908	0.9986	0.9995	(86)
MIT	19.4447	19.6041	19.8942	20.2863	20.6452	20.8847	20.9690	20.9507	20.7471	20.2702	19.7844	19.4171	(87)
Th 2	19.8248	19.8266	19.8283	19.8364	19.8380	19.8451	19.8451	19.8464	19.8423	19.8380	19.8349	19.8317	(88)
util rest of house	0.9991	0.9976	0.9920	0.9679	0.8876	0.7044	0.4919	0.5636	0.8639	0.9853	0.9980	0.9993	(89)
MIT 2	18.4086	18.5691	18.8596	19.2522	19.5905	19.7901	19.8372	19.8319	19.6916	19.2418	18.7560	18.3864	(90)
Living area fraction	18.5324	18.6928	18.9832	19.3757	19.7165	19.9209	19.9724	19.9656	19.8177	19.3646	18.8788	18.5095	(91)
MIT	18.5324	18.6928	18.9832	19.3757	19.7165	19.9209	19.9724	19.9656	19.8177	19.3646	18.8788	18.5095	(92)
Temperature adjustment	18.5324	18.6928	18.9832	19.3757	19.7165	19.9209	19.9724	19.9656	19.8177	19.3646	18.8788	18.5095	(93)
adjusted MIT	18.5324	18.6928	18.9832	19.3757	19.7165	19.9209	19.9724	19.9656	19.8177	19.3646	18.8788	18.5095	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	532.5962	639.7154	761.0860	874.7861	883.3787	705.4567	481.5592	499.8737	652.0995	610.1618	525.4345	499.2525	(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	2123.7168	2054.5954	1856.3956	1545.5474	1180.9606	778.3981	493.3575	520.9432	838.7100	1291.1706	1740.4504	2121.0418	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating kWh	1183.7938	950.7994	814.9103	482.9481	221.4009	0.0000	0.0000	0.0000	0.0000	506.6706	874.8114	1206.6112	(98)
Space heating													6241.9457 (98)
Space heating per m2													55.2385 (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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1375.1434	1082.5597	1110.3769	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7891	0.8667	0.8262	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.1116	938.2650	917.3901	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1271.0979	1214.4262	1118.8736	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	133.9101	205.4639	149.9037	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			489.2777 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	33.4775	51.3660	37.4759	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												122.3194 (107)
Energy for space heating												1.0825 (108)
Energy for space cooling												55.2385 (99)
Total												1.0825 (108)
Dwelling Fabric Energy Efficiency (DFEE)												56.3209 (109)
												56.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1394 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3894 (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) =				0.3310 (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	0.4221	0.4138	0.4055	0.3641	0.3558	0.3145	0.3145	0.3062	0.3310	0.3558	0.3724	0.3889 (22b)
Effective ac	0.5891	0.5856	0.5822	0.5663	0.5633	0.5494	0.5494	0.5469	0.5548	0.5633	0.5693	0.5756 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			4.0000	1.0000	4.0000		(26)
TER Opening Type (Uw = 1.40)			16.8500	1.3258	22.3390		(27)
ground			46.2000	0.1300	6.0060		(28a)
exposed			19.1000	0.1300	2.4830		(28b)
external	157.4600	20.8500	136.6100	0.1800	24.5898		(29a)
cold	55.5000		55.5000	0.1300	7.2150		(30)
sloped	12.0000		12.0000	0.1300	1.5600		(30)
Total net area of external elements Aum(A, m ²)			290.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.1928		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.5105 (36)
Total fabric heat loss						(33) + (36) =	85.7033 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	55.7649	55.4375	55.1166	53.6093	53.3273	52.0144	52.0144	51.7713	52.5201	53.3273	53.8978	54.4942 (38)
Heat transfer coeff	141.4683	141.1409	140.8199	139.3126	139.0306	137.7177	137.7177	137.4746	138.2234	139.0306	139.6011	140.1976 (39)
Average = Sum(39)m / 12 =												139.3112 (39)
HLP	1.2519	1.2490	1.2462	1.2329	1.2304	1.2187	1.2187	1.2166	1.2232	1.2304	1.2354	1.2407 (40)
HLP (average)												1.2328 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)										Total = Sum(45)m =		1596.2429 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	35.1680	30.7581	31.7396	27.6714	26.5513	22.9118	21.2311	24.3630	24.6540	28.7319	31.3631	34.0583 (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	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	141.5842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.0237	23.1141	18.7976	14.2310	10.6378	8.9809	9.7042	12.6139	16.9303	21.4969	25.0901	26.7470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.7977	278.6596	271.4476	256.0943	236.7134	218.4981	206.3292	203.4673	210.6792	226.0326	245.4135	263.6287	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	37.1584	(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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	(71)
Water heating gains (Table 5)	47.2688	45.7710	42.6608	38.4325	35.6873	31.8219	28.5365	32.7460	34.2417	38.6181	43.5598	45.7773	(72)
Total internal gains	414.5654	413.0199	398.3813	374.2330	348.5138	324.7762	310.0451	314.3025	327.3265	351.6229	379.5387	401.6283	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North		0.6500	10.6334	0.6300	0.7000	0.7700	2.1123	(74)
East		6.9500	19.6403	0.6300	0.7000	0.7700	41.7161	(76)
South		0.6500	46.7521	0.6300	0.7000	0.7700	9.2872	(78)
West		8.6000	19.6403	0.6300	0.7000	0.7700	51.6200	(80)

Solar gains	104.7356	201.8320	326.9261	471.4568	575.1096	588.0233	560.0790	482.5327	378.2036	237.8634	129.9934	86.5410	(83)
Total gains	519.3010	614.8519	725.3074	845.6898	923.6234	912.7995	870.1241	796.8351	705.5301	589.4863	509.5321	488.1693	(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	55.4698	55.5985	55.7252	56.3282	56.4424	56.9805	56.9805	57.0812	56.7720	56.4424	56.2118	55.9726	
alpha	4.6980	4.7066	4.7150	4.7552	4.7628	4.7987	4.7987	4.8054	4.7848	4.7628	4.7475	4.7315	
util living area	0.9994	0.9984	0.9951	0.9809	0.9328	0.8127	0.6539	0.7206	0.9254	0.9917	0.9987	0.9995	(86)
MIT	19.4957	19.6460	19.9217	20.2990	20.6466	20.8855	20.9697	20.9522	20.7533	20.2945	19.8284	19.4732	(87)
Th 2	19.8787	19.8810	19.8832	19.8938	19.8958	19.9050	19.9050	19.9068	19.9015	19.8958	19.8918	19.8876	(88)
util rest of house	0.9991	0.9979	0.9932	0.9725	0.9007	0.7247	0.5117	0.5824	0.8755	0.9869	0.9981	0.9994	(89)
MIT 2	18.5037	18.6557	18.9322	19.3132	19.6439	19.8483	19.8969	19.8920	19.7504	19.3137	18.8466	18.4882	(90)
Living area fraction									fLA = Living area / (4) =			0.1195	(91)
MIT	18.6223	18.7740	19.0504	19.4310	19.7637	19.9722	20.0251	20.0186	19.8702	19.4309	18.9639	18.6059	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6223	18.7740	19.0504	19.4310	19.7637	19.9722	20.0251	20.0186	19.8702	19.4309	18.9639	18.6059	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	518.6564	613.0410	718.8509	818.4577	827.5035	667.2083	459.9155	476.6961	616.4017	580.0431	508.2212	487.7220	(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	2026.1452	1958.1869	1767.3525	1467.0974	1121.0985	739.8507	471.6914	497.4714	797.5787	1227.7613	1656.2094	2019.6751	(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	1121.5717	903.9381	780.0852	467.0206	218.4347	0.0000	0.0000	0.0000	0.0000	481.9023	826.5515	1139.7731	(98)
Space heating												5939.2772	(98)
Space heating per m2										(98) / (4) =		52.5600	(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	1294.5467	1019.1112	1044.8071	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7868	0.8663	0.8272	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1018.5226	882.8935	864.2602	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1179.1462	1126.8443	1043.4179	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	115.6490	181.4993	133.2934	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												430.4417 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	28.9123	45.3748	33.3233	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												107.6104 (107)
Space cooling per m2												0.9523 (108)
Energy for space heating												52.5600 (99)
Energy for space cooling												0.9523 (108)
Total												53.5123 (109)
Target Fabric Energy Efficiency (TFEE)												61.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.0900	
Infiltration rate											0.2045	(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) =	0.1738 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Adj infilt rate	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
	0.2042	0.1912	0.1912	0.1738	0.1782	0.1695	0.1695	0.1651	0.1651	0.1782	0.1738	0.1782 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
entrance			4.0000	1.0000	4.0000		(26)					
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)					
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)					
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)					
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)					
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)					
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)					
Total net area of external elements Aum(A, m2)			290.2600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2797		(33)					
stud			176.1000			9.0000	1584.9001 (32c)					
block			13.8000			75.0000	1035.0000 (32c)					
internal			46.2000			18.0000	831.6000 (32d)					
internal			46.2000			9.0000	415.8000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		28813.3011 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							254.9850 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0276 (36)					
Total fabric heat loss						(33) + (36) =	95.3073 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.3336	Feb 47.3336	Mar 47.3336	Apr 47.3336	May 47.3336	Jun 47.3336	Jul 47.3336	Aug 47.3336	Sep 47.3336	Oct 47.3336	Nov 47.3336	Dec 47.3336 (38)
Heat transfer coeff	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409 (39)
Average = Sum(39)m / 12 =												142.6409 (39)
HLP	Jan 1.2623	Feb 1.2623	Mar 1.2623	Apr 1.2623	May 1.2623	Jun 1.2623	Jul 1.2623	Aug 1.2623	Sep 1.2623	Oct 1.2623	Nov 1.2623	Dec 1.2623 (40)
HLP (average)												1.2623 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)										Total = Sum (45)m =		1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (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	14.1538	12.7727	14.1150	13.6235	14.0425	13.5491	13.9755	14.0190	13.5896	14.0811	13.6670	14.1412 (61)
Total heat required for water heating calculated for each month	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	58.5659	51.3206	53.1919	46.7034	45.0557	39.2375	36.7144	41.6257	41.9737	48.4772	52.4908	56.8265 (65)
												1762 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.0594	57.7851	46.9940	35.5775	26.5946	22.4523	24.2605	31.5347	42.3258	53.7423	62.7252	66.8676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.6383	415.9098	405.1457	382.2303	353.3036	326.1166	307.9541	303.6825	314.4466	337.3621	366.2887	393.4757 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218 (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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674 (71)
Water heating gains (Table 5)	78.7177	76.3699	71.4945	64.8659	60.5587	54.4965	49.3473	55.9486	58.2968	65.1575	72.9038	76.3797 (72)
Total internal gains	669.8708	664.5203	638.0898	597.1291	554.9124	517.5209	496.0173	505.6213	529.5247	570.7174	616.3733	651.1785 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				0.6500	13.4684	0.4500	0.0000	0.7700	3.0334 (74)			
East				6.9500	25.1733	0.4500	0.0000	0.7700	60.6216 (76)			
South				0.6500	56.5862	0.4500	0.0000	0.7700	12.7446 (78)			
West				8.6000	25.1733	0.4500	0.0000	0.7700	75.0138 (80)			
Solar gains	151.4134	248.4024	408.8677	589.6518	674.7510	762.4329	698.0928	629.0627	494.4384	315.7611	187.3516	118.3992 (83)
Total gains	821.2842	912.9227	1046.9574	1186.7809	1229.6634	1279.9538	1194.1100	1134.6840	1023.9631	886.4785	803.7248	769.5776 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108
alpha	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407
util living area	0.9941	0.9898	0.9731	0.9165	0.7879	0.5508	0.3913	0.3990	0.7105	0.9370	0.9869	0.9954 (86)
MIT	19.8929	20.0087	20.2841	20.6254	20.8733	20.9820	20.9972	20.9971	20.9429	20.6480	20.2175	19.8640 (87)
Th 2	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705 (88)
util rest of house	0.9919	0.9861	0.9629	0.8850	0.7139	0.4373	0.2590	0.2600	0.5961	0.9039	0.9810	0.9936 (89)
MIT 2	18.8912	19.0056	19.2752	19.5951	19.8000	19.8651	19.8702	19.8702	19.8486	19.6242	19.2134	18.8626 (90)
Living area fraction									fLA = Living area / (4) =			0.1195 (91)
MIT	19.0109	19.1254	19.3957	19.7181	19.9282	19.9986	20.0048	20.0048	19.9793	19.7465	19.3334	18.9822 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8609	18.9754	19.2457	19.5681	19.7782	19.8486	19.8548	19.8548	19.8293	19.5965	19.1834	18.8322 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9891	0.9819	0.9554	0.8746	0.7070	0.4350	0.2571	0.2580	0.5915	0.8934	0.9758	0.9913 (94)
Useful gains	812.3074	896.4136	1000.2681	1037.9409	869.3924	556.7292	306.9982	292.7443	605.6417	791.9548	784.2729	762.8534 (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	1891.5442	1850.8292	1661.1593	1350.5440	952.5847	563.2251	307.3651	293.0996	631.8035	1069.3070	1509.6216	1873.1902 (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	802.9522	641.3673	491.7030	225.0742	61.8950	0.0000	0.0000	0.0000	0.0000	206.3500	522.2511	826.0906 (98)
Space heating												3777.6835 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

3778 (98)

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	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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					4.0900
Infiltration rate					0.2045 (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)	=	0.1738 (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	0.2216	0.2173	0.2129	0.1912	0.1869	0.1651	0.1651	0.1608	0.1738	0.1869	0.1956	0.2042 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)
Total net area of external elements Aum(A, m ²)			290.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2797		(33)
stud			176.1000			9.0000	1584.9001 (32c)
block			13.8000			75.0000	1035.0000 (32c)
internal			46.2000			18.0000	831.6000 (32d)
internal			46.2000			9.0000	415.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28813.3011 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							254.9850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0276 (36)
Total fabric heat loss						(33) + (36) =	95.3073 (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	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336 (38)
Heat transfer coeff	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409 (39)
Average = Sum(39)m / 12 =												142.6409 (39)
HLP	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623 (40)
HLP (average)												1.2623 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)										Total = Sum (45)m =		1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (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	14.1538	12.7727	14.1150	13.6235	14.0425	13.5491	13.9755	14.0190	13.5896	14.0811	13.6670	14.1412 (61)
Total heat required for water heating calculated for each month	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (64)
Heat gains from water heating, kWh/month	58.5659	51.3206	53.1919	46.7034	45.0557	39.2375	36.7144	41.6257	41.9737	48.4772	52.4908	56.8265 (65)
Total per year (kWh/year) = Sum (64)m = 1761.9728 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.0594	57.7851	46.9940	35.5775	26.5946	22.4523	24.2605	31.5347	42.3258	53.7423	62.7252	66.8676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.6383	415.9098	405.1457	382.2303	353.3036	326.1166	307.9541	303.6825	314.4466	337.3621	366.2887	393.4757 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218 (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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674 (71)
Water heating gains (Table 5)	78.7177	76.3699	71.4945	64.8659	60.5587	54.4965	49.3473	55.9486	58.2968	65.1575	72.9038	76.3797 (72)
Total internal gains	669.8708	664.5203	638.0898	597.1291	554.9124	517.5209	496.0173	505.6213	529.5247	570.7174	616.3733	651.1785 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	0.6500	10.6334	0.4500	0.0000	0.7700	2.3949 (74)
East	6.9500	19.6403	0.4500	0.0000	0.7700	47.2972 (76)
South	0.6500	46.7521	0.4500	0.0000	0.7700	10.5297 (78)
West	8.6000	19.6403	0.4500	0.0000	0.7700	58.5260 (80)

Solar gains	118.7479	228.8344	370.6645	534.5315	652.0517	666.6930	635.0102	547.0892	428.8022	269.6864	147.3849	98.1190 (83)
Total gains	788.6186	893.3547	1008.7543	1131.6607	1206.9640	1184.2139	1131.0275	1052.7104	958.3269	840.4038	763.7581	749.2975 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108
alpha	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407
util living area	0.9965	0.9930	0.9827	0.9489	0.8624	0.7046	0.5392	0.5966	0.8366	0.9695	0.9933	0.9972 (86)
MIT	19.7197	19.8696	20.1362	20.4770	20.7709	20.9370	20.9858	20.9774	20.8537	20.4637	20.0182	19.6773 (87)
Th 2	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705 (88)
util rest of house	0.9952	0.9906	0.9764	0.9295	0.8110	0.6058	0.4088	0.4632	0.7577	0.9541	0.9905	0.9963 (89)
MIT 2	18.7186	18.8675	19.1308	19.4590	19.7209	19.8429	19.8672	19.8645	19.7927	19.4530	19.0162	18.6764 (90)
Living area fraction	18.8382	18.9872	19.2509	19.5806	19.8463	19.9736	20.0008	19.9975	19.9195	19.5737	19.1359	18.7960 (91)
MIT	18.8382	18.9872	19.2509	19.5806	19.8463	19.9736	20.0008	19.9975	19.9195	19.5737	19.1359	18.7960 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6882	18.8372	19.1009	19.4306	19.6963	19.8236	19.8508	19.8475	19.7695	19.4237	18.9859	18.6460 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9934	0.9875	0.9706	0.9198	0.8017	0.6013	0.4064	0.4603	0.7492	0.9457	0.9873	0.9947 (94)
Ext temp.	783.3845	882.1502	979.0496	1040.9043	967.5779	712.0670	459.6792	484.5597	718.0134	794.7553	754.0840	745.3447 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2052.3457	1988.0209	1797.4023	1502.0991	1140.5993	745.1007	463.6963	491.7507	808.6960	1258.6246	1695.4179	2060.5857 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	944.1071	743.1451	608.8544	332.0603	128.7279	0.0000	0.0000	0.0000	0.0000	345.1187	677.7604	978.5393 (98)
Space heating per m ²												4758.3132 (98)
										(98) / (4) =		42.1090 (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													5257.8046 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	944.1071	743.1451	608.8544	332.0603	128.7279	0.0000	0.0000	0.0000	0.0000	345.1187	677.7604	978.5393	(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)	1043.2123	821.1548	672.7672	366.9174	142.2408	0.0000	0.0000	0.0000	0.0000	381.3467	748.9065	1081.2589	(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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155	(64)
Efficiency of water heater (217)m	89.9728	89.9235	89.8032	89.5083	88.8099	87.3000	87.3000	87.3000	87.3000	89.5093	89.8669	90.0009	(216)
Fuel for water heating, kWh/month	199.6715	175.1674	182.0401	160.7021	156.5028	139.0255	130.4545	147.3867	148.4634	166.7870	179.4410	193.7930	(219)
Water heating fuel used												1979.4348	(219)
Annual totals kWh/year													
Space heating fuel - main system												5257.8046	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)												75.7473	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												150.7473	(231)
Electricity for lighting (calculated in Appendix L)												459.5874	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 908 * 1.00) =										-871.5401		-871.5401	(233)
Total delivered energy for all uses												6976.0341	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5257.8046	3.4800	182.9716 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1979.4348	3.4800	68.8843 (247)
Mechanical ventilation fans	75.7473	13.1900	9.9911 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	459.5874	13.1900	60.6196 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-871.5401	13.1900	-114.9561 (252)
Total energy cost			337.4029 (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] = 0.8969 (257)
SAP value	87.4883
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	5257.8046	0.2160	1135.6858 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.4348	0.2160	427.5579 (264)
Space and water heating			1563.2437 (265)
Pumps and fans	150.7473	0.5190	78.2379 (267)
Energy for lighting	459.5874	0.5190	238.5259 (268)
Energy saving/generation technologies			
PV Unit	-871.5401	0.5190	-452.3293 (269)
Total kg/year			1427.6781 (272)
CO2 emissions per m2			12.6300 (273)
EI value			87.8918

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating 88 (274)
EI band B

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	$3.48 / 0.8888 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8888 = 0.2430$, 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	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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					4.0900
Infiltration rate					0.2045 (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)	=	0.1738 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.2042	0.1912	0.1912	0.1738	0.1782	0.1695	0.1695	0.1651	0.1651	0.1782	0.1738	0.1782 (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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)
Total net area of external elements Aum(A, m ²)			290.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2797		(33)
stud			176.1000			9.0000	1584.9001 (32c)
block			13.8000			75.0000	1035.0000 (32c)
internal			46.2000			18.0000	831.6000 (32d)
internal			46.2000			9.0000	415.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28813.3011 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							254.9850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0276 (36)
Total fabric heat loss						(33) + (36) =	95.3073 (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	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336 (38)
Heat transfer coeff	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409 (39)
Average = Sum(39)m / 12 =												142.6409 (39)
HLP	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623 (40)
HLP (average)												1.2623 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)										Total = Sum (45)m =		1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (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	14.1538	12.7727	14.1150	13.6235	14.0425	13.5491	13.9755	14.0190	13.5896	14.0811	13.6670	14.1412 (61)
Total heat required for water heating calculated for each month	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (64)
Heat gains from water heating, kWh/month	58.5659	51.3206	53.1919	46.7034	45.0557	39.2375	36.7144	41.6257	41.9737	48.4772	52.4908	56.8265 (65)
Total per year (kWh/year) = Sum (64)m =												
												1761.9728 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.0594	57.7851	46.9940	35.5775	26.5946	22.4523	24.2605	31.5347	42.3258	53.7423	62.7252	66.8676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.6383	415.9098	405.1457	382.2303	353.3036	326.1166	307.9541	303.6825	314.4466	337.3621	366.2887	393.4757 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218 (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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674 (71)
Water heating gains (Table 5)	78.7177	76.3699	71.4945	64.8659	60.5587	54.4965	49.3473	55.9486	58.2968	65.1575	72.9038	76.3797 (72)
Total internal gains	669.8708	664.5203	638.0898	597.1291	554.9124	517.5209	496.0173	505.6213	529.5247	570.7174	616.3733	651.1785 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	0.6500	13.4684	0.4500	0.0000	0.7700	3.0334 (74)
East	6.9500	25.1733	0.4500	0.0000	0.7700	60.6216 (76)
South	0.6500	56.5862	0.4500	0.0000	0.7700	12.7446 (78)
West	8.6000	25.1733	0.4500	0.0000	0.7700	75.0138 (80)

Solar gains	151.4134	248.4024	408.8677	589.6518	674.7510	762.4329	698.0928	629.0627	494.4384	315.7611	187.3516	118.3992 (83)
Total gains	821.2842	912.9227	1046.9574	1186.7809	1229.6634	1279.9538	1194.1100	1134.6840	1023.9631	886.4785	803.7248	769.5776 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108
alpha	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407
util living area	0.9941	0.9898	0.9731	0.9165	0.7879	0.5508	0.3913	0.3990	0.7105	0.9370	0.9869	0.9954 (86)
MIT	19.8929	20.0087	20.2841	20.6254	20.8733	20.9820	20.9972	20.9971	20.9429	20.6480	20.2175	19.8640 (87)
Th 2	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705 (88)
util rest of house	0.9919	0.9861	0.9629	0.8850	0.7139	0.4373	0.2590	0.2600	0.5961	0.9039	0.9810	0.9936 (89)
MIT 2	18.8912	19.0056	19.2752	19.5951	19.8000	19.8651	19.8702	19.8702	19.8486	19.6242	19.2134	18.8626 (90)
Living area fraction	19.0109	19.1254	19.3957	19.7181	19.9282	19.9986	20.0048	20.0048	fLA = Living area / (4) =	19.9793	19.7465	19.3334
MIT	18.8609	18.9754	19.2457	19.5681	19.7782	19.8486	19.8548	19.8548	19.8293	19.5965	19.1834	18.9822 (91)
Temperature adjustment												-0.1500
adjusted MIT												18.8322 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9891	0.9819	0.9554	0.8746	0.7070	0.4350	0.2571	0.2580	0.5915	0.8934	0.9758	0.9913 (94)
Ext temp.	812.3074	896.4136	1000.2681	1037.9409	869.3924	556.7292	306.9982	292.7443	605.6417	791.9548	784.2729	762.8534 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1891.5442	1850.8292	1661.1593	1350.5440	952.5847	563.2251	307.3651	293.0996	631.8035	1069.3070	1509.6216	1873.1902 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	802.9522	641.3673	491.7030	225.0742	61.8950	0.0000	0.0000	0.0000	0.0000	206.3500	522.2511	826.0906 (98)
Space heating per m2												3777.6835 (98)
												(98) / (4) = 33.4308 (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													4174.2359 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	802.9522	641.3673	491.7030	225.0742	61.8950	0.0000	0.0000	0.0000	0.0000	206.3500	522.2511	826.0906	(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)	887.2400	708.6932	543.3182	248.7008	68.3923	0.0000	0.0000	0.0000	0.0000	228.0110	577.0730	912.8073	(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	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155	(64)
Efficiency of water heater (217)m	89.8975	89.8506	89.6798	89.2248	88.2616	87.3000	87.3000	87.3000	87.3000	89.1286	89.7241	89.9254	(216)
Fuel for water heating, kWh/month	199.8386	175.3096	182.2907	161.2127	157.4751	139.0255	130.4545	147.3867	148.4634	167.4995	179.7266	193.9558	(219)
Water heating fuel used												1982.6386	(219)
Annual totals kWh/year													
Space heating fuel - main system												4174.2359	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)												75.7473	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												150.7473	(231)
Electricity for lighting (calculated in Appendix L)												459.5874	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1030 * 1.00) =										-988.8571		-988.8571	(233)
Total delivered energy for all uses												5778.3521	(238)

10a. Fuel costs - using BEDF prices (520)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4174.2359	9.7400	406.5706 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1982.6386	9.7400	193.1090 (247)
Mechanical ventilation fans	75.7473	36.8500	27.9129 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	459.5874	36.8500	169.3580 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-988.8571	36.8500	-364.3938 (252)
Total energy cost			564.1941 (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	4174.2359	0.2160	901.6349 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1982.6386	0.2160	428.2499 (264)
Space and water heating			1329.8849 (265)
Pumps and fans	150.7473	0.5190	78.2379 (267)
Energy for lighting	459.5874	0.5190	238.5259 (268)
Energy saving/generation technologies			
PV Unit	-988.8571	0.5190	-513.2168 (269)
Total kg/year			1133.4318 (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	4174.2359	1.2200	5092.5677 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1982.6386	1.2200	2418.8191 (264)
Space and water heating			7511.3868 (265)
Pumps and fans	150.7473	3.0700	462.7943 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	459.5874	3.0700	1410.9333 (268)
Energy saving/generation technologies			
PV Unit	-988.8571	3.0700	-3035.7911 (269)
Primary energy kWh/year			6349.3232 (272)
Primary energy kWh/m2/year			56.1887 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(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	+ 1.0	-£ 82	-196 kg (17.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£82 1.73 kg/m²	B 89	B 89
Total Savings	£82 1.73 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 520 TEST (05 Jun 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	£225	£243	-£18
Mains gas	£704	£604	£100
Space heating	£566	£566	£0
Water heating	£193	£112	£82
Lighting	£169	£169	£0
Generated (PV)	-£364	-£364	£0
Total cost of fuels	£565	£483	£82
Total cost of uses	£564	£483	£82
Delivered energy	51 kWh/m²	42 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	46 kWh/m²	10 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	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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					4.0900
Infiltration rate					0.2045 (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) =		0.1738 (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	0.2216	0.2173	0.2129	0.1912	0.1869	0.1651	0.1651	0.1608	0.1738	0.1869	0.1956	0.2042 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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			4.0000	1.0000	4.0000		(26)
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)
Total net area of external elements Aum(A, m ²)			290.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2797		(33)
stud			176.1000			9.0000	1584.9001 (32c)
block			13.8000			75.0000	1035.0000 (32c)
internal			46.2000			18.0000	831.6000 (32d)
internal			46.2000			9.0000	415.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28813.3011 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							254.9850 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0276 (36)
Total fabric heat loss						(33) + (36) =	95.3073 (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	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336	47.3336 (38)
Heat transfer coeff	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409 (39)
Average = Sum(39)m / 12 =												142.6409 (39)
HLP	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623	1.2623 (40)
HLP (average)												1.2623 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)										Total =	Sum (45)m =	1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (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	14.1538	12.7727	14.1150	13.6235	14.0425	13.5491	13.9755	14.0190	13.5896	14.0811	13.6670	14.1412 (61)
Total heat required for water heating calculated for each month	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (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												1.1362 (H8)
Utilisation factor												0.5853 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.4525 (H14)
Volume ratio Veff/V												0.7393 (H15)
Solar storage volume factor												0.9396 (H16)
Solar input												-876.9456 (H17)
Solar input	-25.4297	-42.4348	-72.2713	-96.8578	-119.6597	-117.6446	-116.0898	-101.4283	-79.4387	-54.2473	-30.1633	-21.2803 (63)
Solar input (sum of months) = Sum (63)m =												-876.9456 (63)
Output from w/h	154.2203	115.0819	91.2066	46.9839	19.3303	3.7247	0.0000	27.2403	50.1698	95.0426	131.0948	153.1352 (64)
Total per year (kWh/year) = Sum (64)m =												887.2304 (64)
Heat gains from water heating, kWh/month	58.5659	51.3206	53.1919	46.7034	45.0557	39.2375	36.7144	41.6257	41.9737	48.4772	52.4908	56.8265 (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	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.0594	57.7851	46.9940	35.5775	26.5946	22.4523	24.2605	31.5347	42.3258	53.7423	62.7252	66.8676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.6383	415.9098	405.1457	382.2303	353.3036	326.1166	307.9541	303.6825	314.4466	337.3621	366.2887	393.4757	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	(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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	(71)
Water heating gains (Table 5)	78.7177	76.3699	71.4945	64.8659	60.5587	54.4965	49.3473	55.9486	58.2968	65.1575	72.9038	76.3797	(72)
Total internal gains	669.8708	664.5203	638.0898	597.1291	554.9124	517.5209	496.0173	505.6213	529.5247	570.7174	616.3733	651.1785	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North				0.6500	10.6334	0.4500	0.0000		0.7700	2.3949 (74)		
East				6.9500	19.6403	0.4500	0.0000		0.7700	47.2972 (76)		
South				0.6500	46.7521	0.4500	0.0000		0.7700	10.5297 (78)		
West				8.6000	19.6403	0.4500	0.0000		0.7700	58.5260 (80)		

Solar gains	118.7479	228.8344	370.6645	534.5315	652.0517	666.6930	635.0102	547.0892	428.8022	269.6864	147.3849	98.1190 (83)
Total gains	788.6186	893.3547	1008.7543	1131.6607	1206.9640	1184.2139	1131.0275	1052.7104	958.3269	840.4038	763.7581	749.2975 (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	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	
alpha	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	
util living area	0.9965	0.9930	0.9827	0.9489	0.8624	0.7046	0.5392	0.5966	0.8366	0.9695	0.9933	0.9972	(86)
MIT	19.7197	19.8696	20.1362	20.4770	20.7709	20.9370	20.9858	20.9774	20.8537	20.4637	20.0182	19.6773	(87)
Th 2	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	(88)
util rest of house	0.9952	0.9906	0.9764	0.9295	0.8110	0.6058	0.4088	0.4632	0.7577	0.9541	0.9905	0.9963	(89)
MIT 2	18.7186	18.8675	19.1308	19.4590	19.7209	19.8429	19.8672	19.8645	19.7927	19.4530	19.0162	18.6764	(90)
Living area fraction									fLA =	Living area / (4) =		0.1195	(91)
MIT	18.8382	18.9872	19.2509	19.5806	19.8463	19.9736	20.0008	19.9975	19.9195	19.5737	19.1359	18.7960	(92)
Temperature adjustment												-0.1500	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 18.6882 18.8372 19.1009 19.4306 19.6963 19.8236 19.8508 19.8475 19.7695 19.4237 18.9859 18.6460 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9875	0.9706	0.9198	0.8017	0.6013	0.4064	0.4603	0.7492	0.9457	0.9873	0.9947	(94)
Useful gains	783.3845	882.1502	979.0496	1040.9043	967.5779	712.0670	459.6792	484.5597	718.0134	794.7553	754.0840	745.3447	(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	2052.3457	1988.0209	1797.4023	1502.0991	1140.5993	745.1007	463.6963	491.7507	808.6960	1258.6246	1695.4179	2060.5857	(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	944.1071	743.1451	608.8544	332.0603	128.7279	0.0000	0.0000	0.0000	0.0000	345.1187	677.7604	978.5393	(98)
Space heating												4758.3132	(98)
Space heating per m2												(98) / (4) =	42.1090 (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													5257.8046 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	944.1071	743.1451	608.8544	332.0603	128.7279	0.0000	0.0000	0.0000	0.0000	345.1187	677.7604	978.5393	(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)	1043.2123	821.1548	672.7672	366.9174	142.2408	0.0000	0.0000	0.0000	0.0000	381.3467	748.9065	1081.2589	(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	154.2203	115.0819	91.2066	46.9839	19.3303	3.7247	0.0000	27.2403	50.1698	95.0426	131.0948	153.1352	(64)
Efficiency of water heater (217)m	90.0366	90.0574	90.0699	90.0907	90.0690	87.3000	87.3000	87.3000	87.3000	89.7893	89.9655	90.0533	(216)
Fuel for water heating, kWh/month	171.2863	127.7874	101.2621	52.1518	21.4617	4.2665	0.0000	31.2031	57.4683	105.8507	145.7167	170.0495	(219)
Water heating fuel used												988.5038	(219)
Annual totals kWh/year													
Space heating fuel - main system												5257.8046	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)													75.7473 (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													200.7473 (231)
Electricity for lighting (calculated in Appendix L)													459.5874 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 908 * 1.00) =										-871.5401		-871.5401	(233)
Total delivered energy for all uses												6035.1031	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5257.8046	3.4800	182.9716	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	988.5038	3.4800	34.3999	(247)
Mechanical ventilation fans	75.7473	13.1900	9.9911	(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	459.5874	13.1900	60.6196	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-871.5401	13.1900	-114.9561	(252)
Total energy cost			309.5135	(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] =	0.8228 (257)
SAP value		88.5225
SAP rating (Section 12)		89 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	5257.8046	0.2160	1135.6858 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	988.5038	0.2160	213.5168 (264)
Space and water heating			1349.2026 (265)
Pumps and fans	200.7473	0.5190	104.1879 (267)
Energy for lighting	459.5874	0.5190	238.5259 (268)
Energy saving/generation technologies			
PV Unit	-871.5401	0.5190	-452.3293 (269)
Total kg/year			1239.5870 (272)
CO2 emissions per m2			10.9700 (273)
EI value			89.4870
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.2000 (1b)	x 2.4500 (2b)	= 113.1900 (1b) - (3b)
First floor	66.8000 (1c)	x 2.6000 (2c)	= 173.6800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 286.8700 (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												4.0900
Infiltration rate												0.2045 (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) =	0.1738 (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												
	0.2042	0.1912	0.1912	0.1738	0.1782	0.1695	0.1695	0.1651	0.1651	0.1782	0.1738	0.1782 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
entrance			4.0000	1.0000	4.0000		(26)					
front (Uw = 1.40)			16.8500	1.3258	22.3390		(27)					
ground			46.2000	0.1200	5.5440	75.0000	3465.0001 (28a)					
exposed			19.1000	0.1700	3.2470	20.0000	382.0000 (28b)					
external	157.4600	20.8500	136.6100	0.2700	36.8847	150.0000	20491.5010 (29a)					
cold	55.5000		55.5000	0.1100	6.1050	9.0000	499.5000 (30)					
sloped	12.0000		12.0000	0.1800	2.1600	9.0000	108.0000 (30)					
Total net area of external elements Aum(A, m2)			290.2600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2797		(33)					
stud			176.1000			9.0000	1584.9001 (32c)					
block			13.8000			75.0000	1035.0000 (32c)					
internal			46.2000			18.0000	831.6000 (32d)					
internal			46.2000			9.0000	415.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28813.3011 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							254.9850 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0276 (36)					
Total fabric heat loss						(33) + (36) =	95.3073 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.3336	Feb 47.3336	Mar 47.3336	Apr 47.3336	May 47.3336	Jun 47.3336	Jul 47.3336	Aug 47.3336	Sep 47.3336	Oct 47.3336	Nov 47.3336	Dec 47.3336 (38)
Heat transfer coeff	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409	142.6409 (39)
Average = Sum(39)m / 12 =												142.6409 (39)
HLP	Jan 1.2623	Feb 1.2623	Mar 1.2623	Apr 1.2623	May 1.2623	Jun 1.2623	Jul 1.2623	Aug 1.2623	Sep 1.2623	Oct 1.2623	Nov 1.2623	Dec 1.2623 (40)
HLP (average)												1.2623 (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												2.8317 (42)
Average daily hot water use (litres/day)												101.4525 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	111.5977	107.5396	103.4815	99.4234	95.3653	91.3072	91.3072	95.3653	99.4234	103.4815	107.5396	111.5977 (44)
Energy conte	165.4962	144.7441	149.3629	130.2182	124.9475	107.8202	99.9112	114.6496	116.0189	135.2088	147.5910	160.2743 (45)
Energy content (annual)										Total =	Sum (45)m =	1596.2429 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8244	21.7116	22.4044	19.5327	18.7421	16.1730	14.9867	17.1974	17.4028	20.2813	22.1386	24.0411 (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	14.1538	12.7727	14.1150	13.6235	14.0425	13.5491	13.9755	14.0190	13.5896	14.0811	13.6670	14.1412 (61)
Total heat required for water heating calculated for each month	179.6500	157.5167	163.4779	143.8417	138.9900	121.3692	113.8867	128.6686	129.6085	149.2899	161.2580	174.4155 (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												1.2693 (H8)
Utilisation factor												0.5452 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.4525 (H14)
Volume ratio Veff/V												0.7393 (H15)
Solar storage volume factor												0.9396 (H16)
Solar input												-912.5635 (H17)
Solar input	-29.7781	-42.3478	-73.4844	-98.8489	-114.8691	-124.9442	-118.4662	-108.0297	-84.5546	-58.4411	-35.2207	-23.5788 (63)
Solar input (sum of months) = Sum (63)m =												-912.5635 (63)
Output from w/h	149.8719	115.1689	89.9936	44.9929	24.1209	0.0000	0.0000	20.6389	45.0539	90.8488	126.0373	150.8367 (64)
Total per year (kWh/year) = Sum (64)m =												857.5638 (64)
Heat gains from water heating, kWh/month	58.5659	51.3206	53.1919	46.7034	45.0557	39.2375	36.7144	41.6257	41.9737	48.4772	52.4908	56.8265 (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	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	169.9011	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.0594	57.7851	46.9940	35.5775	26.5946	22.4523	24.2605	31.5347	42.3258	53.7423	62.7252	66.8676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.6383	415.9098	405.1457	382.2303	353.3036	326.1166	307.9541	303.6825	314.4466	337.3621	366.2887	393.4757	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	54.8218	(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)	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	-113.2674	(71)
Water heating gains (Table 5)	78.7177	76.3699	71.4945	64.8659	60.5587	54.4965	49.3473	55.9486	58.2968	65.1575	72.9038	76.3797	(72)
Total internal gains	669.8708	664.5203	638.0898	597.1291	554.9124	517.5209	496.0173	505.6213	529.5247	570.7174	616.3733	651.1785	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				0.6500	13.4684	0.4500	0.0000	0.7700	3.0334 (74)			
East				6.9500	25.1733	0.4500	0.0000	0.7700	60.6216 (76)			
South				0.6500	56.5862	0.4500	0.0000	0.7700	12.7446 (78)			
West				8.6000	25.1733	0.4500	0.0000	0.7700	75.0138 (80)			
Solar gains	151.4134	248.4024	408.8677	589.6518	674.7510	762.4329	698.0928	629.0627	494.4384	315.7611	187.3516	118.3992 (83)
Total gains	821.2842	912.9227	1046.9574	1186.7809	1229.6634	1279.9538	1194.1100	1134.6840	1023.9631	886.4785	803.7248	769.5776 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108	56.1108
alpha	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407	4.7407
util living area	0.9941	0.9898	0.9731	0.9165	0.7879	0.5508	0.3913	0.3990	0.7105	0.9370	0.9869	0.9954 (86)
MIT	19.8929	20.0087	20.2841	20.6254	20.8733	20.9820	20.9972	20.9971	20.9429	20.6480	20.2175	19.8640 (87)
Th 2	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705	19.8705 (88)
util rest of house	0.9919	0.9861	0.9629	0.8850	0.7139	0.4373	0.2590	0.2600	0.5961	0.9039	0.9810	0.9936 (89)
MIT 2	18.8912	19.0056	19.2752	19.5951	19.8000	19.8651	19.8702	19.8702	19.8486	19.6242	19.2134	18.8626 (90)
Living area fraction									fLA =	Living area / (4) =		0.1195 (91)
MIT	19.0109	19.1254	19.3957	19.7181	19.9282	19.9986	20.0048	20.0048	19.9793	19.7465	19.3334	18.9822 (92)
Temperature adjustment												-0.1500

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

adjusted MIT 18.8609 18.9754 19.2457 19.5681 19.7782 19.8486 19.8548 19.8548 19.8293 19.5965 19.1834 18.8322 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9891	0.9819	0.9554	0.8746	0.7070	0.4350	0.2571	0.2580	0.5915	0.8934	0.9758	0.9913	(94)
Useful gains	812.3074	896.4136	1000.2681	1037.9409	869.3924	556.7292	306.9982	292.7443	605.6417	791.9548	784.2729	762.8534	(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	1891.5442	1850.8292	1661.1593	1350.5440	952.5847	563.2251	307.3651	293.0996	631.8035	1069.3070	1509.6216	1873.1902	(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	802.9522	641.3673	491.7030	225.0742	61.8950	0.0000	0.0000	0.0000	0.0000	206.3500	522.2511	826.0906	(98)
Space heating													
Space heating per m2													(98) / (4) = 33.4308 (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													4174.2359 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	802.9522	641.3673	491.7030	225.0742	61.8950	0.0000	0.0000	0.0000	0.0000	206.3500	522.2511	826.0906	(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)	887.2400	708.6932	543.3182	248.7008	68.3923	0.0000	0.0000	0.0000	0.0000	228.0110	577.0730	912.8073	(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	149.8719	115.1689	89.9936	44.9929	24.1209	0.0000	0.0000	20.6389	45.0539	90.8488	126.0373	150.8367	(64)
Efficiency of water heater (217)m	89.9812	89.9978	89.9897	89.9507	89.5792	87.3000	87.3000	87.3000	87.3000	89.4972	89.8596	89.9907	(216)
Fuel for water heating, kWh/month	166.5591	127.9686	100.0043	50.0195	26.9269	0.0000	0.0000	23.6414	51.6082	101.5102	140.2602	167.6137	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													4174.2359 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)													75.7473 (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													200.7473 (231)
Electricity for lighting (calculated in Appendix L)													459.5874 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1030 * 1.00) =										-988.8571			-988.8571 (233)
Total delivered energy for all uses													4801.8255 (238)

10a. Fuel costs - using BEDF prices (520)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4174.2359	9.7400	406.5706	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	956.1120	9.7400	93.1253	(247)
Mechanical ventilation fans	75.7473	36.8500	27.9129	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	459.5874	36.8500	169.3580	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.8571	36.8500	-364.3938	(252)
Total energy cost			482.6354	(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	4174.2359	0.2160	901.6349	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water heating (other fuel)	956.1120	0.2160	206.5202 (264)
Space and water heating			1108.1551 (265)
Pumps and fans	200.7473	0.5190	104.1879 (267)
Energy for lighting	459.5874	0.5190	238.5259 (268)
Energy saving/generation technologies			
PV Unit	-988.8571	0.5190	-513.2168 (269)
Total kg/year			937.6520 (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	4174.2359	1.2200	5092.5677 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	956.1120	1.2200	1166.4567 (264)
Space and water heating			6259.0244 (265)
Pumps and fans	200.7473	3.0700	616.2943 (267)
Energy for lighting	459.5874	3.0700	1410.9333 (268)
Energy saving/generation technologies			
PV Unit	-988.8571	3.0700	-3035.7911 (269)
Primary energy kWh/year			5250.4608 (272)
Primary energy kWh/m2/year			46.4643 (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	255.0 (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	378.67 (P1)
Transmission heat loss coefficient	95.31 (37)
Summer heat loss coefficient	473.98 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.6500	87.1704	0.4500	0.0000	0.9000	22.9476
East	6.9500	125.2818	0.4500	0.0000	0.9000	352.6369
South	0.6500	118.5567	0.4500	0.0000	0.9000	31.2100
West	8.6000	125.2818	0.4500	0.0000	0.9000	436.3565
total:						843.1510

Solar gains	Jun 907	Jul 843	Aug 743	(P4)
Internal gains	515	493	503	
Total summer gains	1421	1336	1246	(P5)
Summer gain/loss ratio	3.00	2.82	2.63	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 255.0)	0.22	0.22	0.22	
Threshold temperature	18.61	20.33	20.14	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 27	Issued on Date	22/06/2023
Assessment Reference	27 Hamblewood	Prop Type Ref	21809
Property	2 Red Oak Road, Southampton, SO30 0AU		
SAP Rating	87 B	DER	14.54
Environmental	88 B	TER	18.48
CO ₂ Emissions (t/year)	1.13	% DER<TER	21.30
General Requirements Compliance	Pass	DFEE	56.32
		TFEE	61.54
		% DFEE<TFEE	8.48
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.54	kgCO ₂ /m ²	Pass
	-3.94 (-21.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.54	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	56.32	kWh/m ² /yr	
	-5.2 (-8.5%)	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
Floor	0.13 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.18 (max. 0.35)	Pass
Openings	1.32 (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	4.09 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

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%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

0.65 m², No overhang

Windows facing East

6.95 m², No overhang

Windows facing South

0.65 m², No overhang

Windows facing West

8.60 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.09 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

1.20

kW

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 27	Issued on Date	22/06/2023
Assessment Reference	27 Hamblewood	Prop Type Ref	21809
Property	2 Red Oak Road, Southampton, SO30 0AU		

SAP Rating	87 B	DER	14.54	TER	18.48
Environmental	88 B	% DER<TER	21.30		
CO ₂ Emissions (t/year)	1.13	DFEE	56.32	TFEE	61.54
General Requirements Compliance	Pass	% DFEE<TFEE	8.48		

Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jpsustainability.co.uk	Assessor ID	Y128-0001
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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	46.20 m ²	2.45 m
	1st Storey:	1.00 m	66.80 m ²	2.60 m

7.0 Living Area	13.50	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	254.98	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	157.46	136.61

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
stud	Plasterboard on timber frame		9.00	176.10
block	Dense block, plasterboard on dabs		75.00	13.80

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cold	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	55.50	55.50
sloped	External Slope Roof	Plasterboard, insulated slope	0.18	9.00	12.00	12.00

10.2 Internal Ceilings				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
internal	Other		9.00	46.20

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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	46.20
exposed	Exposed Floor - Solid	Timber exposed floor, insulation between joists	0.17	20.00	19.10

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	46.20

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	
garage	Solid Door	[1] external	North							2.00	
front	Window	[1] external	East	None	0.00					6.95	
rear	Window	[1] external	West	None	0.00					8.60	
side	Window	[1] external	South	None	0.00					0.65	
side	Window	[1] external	North	None	0.00					0.65	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	14.90	0.300	No
Independently assessed	E3 Sill	10.10	0.015	No
Independently assessed	E4 Jamb	30.90	0.011	No
Independently assessed	E5 Ground floor (normal)	28.00	0.020	No
Table K1 - Default	E20 Exposed floor (normal)	15.30	0.320	No
Table K1 - Default	E21 Exposed floor (inverted)	3.60	0.320	No
Independently assessed	E6 Intermediate floor within a dwelling	25.00	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.90	0.060	No
Independently assessed	E11 Eaves (insulation at rafter level)	3.00	0.040	No
Independently assessed	E12 Gable (insulation at ceiling level)	16.90	0.063	No
Independently assessed	E13 Gable (insulation at rafter level)	8.00	0.040	No
Independently assessed	E16 Corner (normal)	20.00	0.067	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	2.45	-0.090	No

Y-value 0.052 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.01 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 4.09 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

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

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	Through Wall Fan Kitchen	1
0.18	In Room Fan Other Wet Room	3

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	28	
Total number of L.E.L. fittings	28	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.20	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	£82	B 89	