

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 70			Issued on Date	27/11/2023
Assessment Reference	21809 plot 70	Prop Type Ref	21809		
Property	2 Wayfaring Close, Southampton, SO30 0AT				
SAP Rating	87 B	DER	14.28	TER	19.21
Environmental	90 B	% DER<TER	25.67		
CO ₂ Emissions (t/year)	0.70	DFEE	47.63	TFEE	53.68
General Requirements Compliance	Pass	% DFEE<TFEE	11.27		
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 70 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.21 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.28 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.6 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.09 (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): Slight OK

Based on:

Overshading: Average
Windows facing North: 2.45 m², No overhang
Windows facing East: 6.35 m², No overhang
Windows facing West: 4.20 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 0.74 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2146			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	53.2240 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878 (39)
Average = Sum(39)m / 12 =												82.3878 (39)
HLP	Jan 1.1770	Feb 1.1770	Mar 1.1770	Apr 1.1770	May 1.1770	Jun 1.1770	Jul 1.1770	Aug 1.1770	Sep 1.1770	Oct 1.1770	Nov 1.1770	Dec 1.1770 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

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Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum(45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8792	15.8802	12.9146	9.7772	7.3086	6.1702	6.6671	8.6662	11.6317	14.7691	17.2378	18.3761 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	343.4246	341.4432	329.1083	309.2660	289.2175	269.8189	257.1682	262.8146	272.9648	293.0071	316.0270	333.1990 (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				2.4500	10.6334	0.4500	0.0000			0.7700	9.0270 (74)	
East				6.3500	19.6403	0.4500	0.0000			0.7700	43.2140 (76)	
West				4.2000	19.6403	0.4500	0.0000			0.7700	28.5825 (80)	

Solar gains	80.8234	157.7001	260.6133	384.4219	476.8469	491.1094	466.3059	396.3903	304.2555	187.1897	100.6576	66.5672 (83)
Total gains	424.2481	499.1433	589.7216	693.6879	766.0644	760.9283	723.4741	659.2050	577.2203	480.1968	416.6847	399.7662 (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	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386
alpha	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959
util living area	0.9978	0.9948	0.9838	0.9416	0.8305	0.6530	0.4924	0.5580	0.8240	0.9733	0.9955	0.9984 (86)
MIT	19.7186	19.8836	20.1734	20.5376	20.8251	20.9591	20.9916	20.9850	20.8751	20.4761	20.0175	19.6750 (87)
Th 2	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385 (88)
util rest of house	0.9971	0.9930	0.9781	0.9210	0.7765	0.5607	0.3781	0.4377	0.7470	0.9601	0.9936	0.9978 (89)
MIT 2	18.7743	18.9385	19.2250	19.5745	19.8256	19.9207	19.9364	19.9344	19.8714	19.5237	19.0726	18.7308 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	18.9524	19.1167	19.4038	19.7561	20.0141	20.1165	20.1354	20.1325	20.0607	19.7033	19.2507	18.9088 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8024	18.9667	19.2538	19.6061	19.8641	19.9665	19.9854	19.9825	19.9107	19.5533	19.1007	18.7588 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	422.5242	494.5138	573.8957	633.3561	591.5941	428.6042	277.2995	291.9387	429.8103	457.9356	413.1563	398.5354 (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	1194.8186	1158.9271	1050.7607	882.0540	672.6236	442.1369	278.9173	295.1560	478.7287	737.6429	988.7143	1199.4696 (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	574.5870	446.4858	354.7876	179.0625	60.2859	0.0000	0.0000	0.0000	0.0000	208.1023	414.4017	595.8950 (98)
Space heating												2833.6078 (98)
Space heating per m2										(98) / (4) =		40.4801 (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													3131.0583 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	574.5870	446.4858	354.7876	179.0625	60.2859	0.0000	0.0000	0.0000	0.0000	208.1023	414.4017	595.8950	(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)	634.9028	493.3544	392.0304	197.8591	66.6143	0.0000	0.0000	0.0000	0.0000	229.9472	457.9024	658.4476	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater	89.7940	89.7252	89.5573	89.1508	88.3342	87.3000	87.3000	87.3000	87.3000	89.2382	89.6658	87.3000	(216)
Fuel for water heating, kWh/month	174.7296	153.3640	159.5862	141.2350	137.8733	122.0263	114.7023	129.3075	130.1650	146.4407	157.2013	169.6328	(219)
Water heating fuel used												1736.2640	(219)
Annual totals kWh/year													
Space heating fuel - main system												3131.0583	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													47.3439 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													122.3439 (231)
Electricity for lighting (calculated in Appendix L)													315.7527 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =										-537.4497			-537.4497 (233)
Total delivered energy for all uses													4767.9691 (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	3131.0583	0.2160	676.3086 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1736.2640	0.2160	375.0330 (264)
Space and water heating			1051.3416 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	315.7527	0.5190	163.8756 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total CO2, kg/year			999.7773 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2800 (273)

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

DER			14.2800 ZC1
Total Floor Area		TFA	70.0000
Assumed number of occupants		N	2.2461
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.7020 ZC2
CO2 emissions from cooking, equation (L16)			2.4701 ZC3
Total CO2 emissions			33.4521 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			33.4521 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000	/ (5) =	0.1132 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3632 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3087 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.3936	0.3859	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3473	0.3627	(22a)				
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658	(22b)				
													(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000		(26)					
TER Opening Type (Uw = 1.40)			13.0000	1.3258	17.2348		(27)					
ground			35.0000	0.1300	4.5500		(28a)					
external	84.8400	15.1000	69.7400	0.1800	12.5532		(29a)					
cd	35.0000		35.0000	0.1300	4.5500		(30)					
Total net area of external elements Aum(A, m2)			154.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	40.9880		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7810 (36)					
Total fabric heat loss						(33) + (36) =	49.7690 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.6811	33.5057	33.3337	32.5261	32.3750	31.6717	31.6717	31.5414	31.9426	32.3750	32.6807	33.0003 (38)
Heat transfer coeff	83.4501	83.2747	83.1028	82.2952	82.1441	81.4407	81.4407	81.3104	81.7116	82.1441	82.4498	82.7693 (39)
Average = Sum(39)m / 12 =												82.2945 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1921	1.1896	1.1872	1.1756	1.1735	1.1634	1.1634	1.1616	1.1673	1.1735	1.1779	1.1824 (40)
HLP (average)												1.1756 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	49.0734	42.7126	45.5045	42.3096	41.9355	38.8558	40.1510	41.9355	42.3096	45.5045	45.7635	49.0734 (61)
Solar input	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (64)
	59.7527	52.2083	54.2315	47.9398	46.3339	40.6498	38.7044	43.3793	43.8657	50.1704	53.7879	58.2544 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8792	15.8802	12.9146	9.7772	7.3086	6.1702	6.6671	8.6662	11.6317	14.7691	17.2378	18.3761	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	80.3128	77.6909	72.8918	66.5830	62.2768	56.4581	52.0220	58.3055	60.9246	67.4333	74.7053	78.2990	(72)
Total internal gains	355.1810	352.6073	339.6835	319.2540	298.6147	278.6270	265.9825	272.2177	282.9615	303.5910	327.1962	344.9588	(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					2.4500	10.6334	0.6300	0.7000			0.7700			7.9618 (74)
East					6.3500	19.6403	0.6300	0.7000			0.7700			38.1147 (76)
West					4.2000	19.6403	0.6300	0.7000			0.7700			25.2097 (80)
Solar gains	71.2862	139.0915	229.8609	339.0601	420.5790	433.1585	411.2818	349.6163	268.3534	165.1013	88.7800	58.7123	(83)	
Total gains	426.4672	491.6988	569.5444	658.3141	719.1936	711.7854	677.2643	621.8340	551.3149	468.6923	415.9762	403.6711	(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	58.2517	58.3744	58.4952	59.0692	59.1779	59.6890	59.6890	59.7846	59.4911	59.1779	58.9585	58.7308	
alpha	4.8834	4.8916	4.8997	4.9379	4.9452	4.9793	4.9793	4.9856	4.9661	4.9452	4.9306	4.9154	
util living area	0.9979	0.9953	0.9864	0.9520	0.8559	0.6831	0.5184	0.5815	0.8416	0.9761	0.9957	0.9984	(86)
MIT	19.7111	19.8660	20.1429	20.5071	20.8017	20.9532	20.9903	20.9834	20.8665	20.4699	20.0230	19.6829	(87)
Th 2	19.9263	19.9283	19.9303	19.9395	19.9413	19.9494	19.9494	19.9509	19.9462	19.9413	19.9378	19.9341	(88)
util rest of house	0.9971	0.9937	0.9815	0.9341	0.8057	0.5903	0.4001	0.4588	0.7677	0.9641	0.9939	0.9978	(89)
MIT 2	18.2126	18.4399	18.8430	19.3654	19.7504	19.9190	19.9459	19.9442	19.8395	19.3240	18.6766	18.1769	(90)
Living area fraction	18.4952	18.7088	19.0881	19.5807	19.9487	20.1140	20.1428	20.1401	20.0332	19.5401	18.9305	18.4609	(92)
Temperature adjustment	18.4952	18.7088	19.0881	19.5807	19.9487	20.1140	20.1428	20.1401	20.0332	19.5401	18.9305	18.4609	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	424.6033	487.2580	555.9764	609.9763	579.7242	431.2012	286.1513	299.6589	427.1382	448.9205	412.3829	402.3080	(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	1184.5896	1149.9282	1046.1049	878.9701	677.5796	449.0649	288.5314	304.1125	484.8108	734.3750	975.4245	1180.3626	(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	565.4298	445.3143	364.6555	193.6755	72.8044	0.0000	0.0000	0.0000	0.0000	212.3781	405.3899	578.8726	(98)
Space heating												2838.5202	(98)
Space heating per m2												40.5503	(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												3039.1008 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	565.4298	445.3143	364.6555	193.6755	72.8044	0.0000	0.0000	0.0000	0.0000	212.3781	405.3899	578.8726 (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)	605.3852	476.7819	390.4235	207.3614	77.9490	0.0000	0.0000	0.0000	0.0000	227.3856	434.0363	619.7779 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (64)
Efficiency of water heater (217)m	87.6080	87.3940	86.8653	85.6183	83.3461	80.3000	80.3000	80.3000	80.3000	85.7310	87.1208	80.3000 (216)
Fuel for water heating, kWh/month	219.0251	191.7926	200.7623	180.6595	179.6787	164.2541	157.3679	175.4284	177.3658	189.1718	198.7159	213.6512 (219)
Water heating fuel used												2247.8734 (219)
Annual totals kWh/year												
Space heating fuel - main system												3039.1008 (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)												315.7527 (232)
Total delivered energy for all uses												5677.7269 (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	3039.1008	0.2160	656.4458 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2247.8734	0.2160	485.5407 (264)
Space and water heating			1141.9864 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	315.7527	0.5190	163.8756 (268)
Total CO2, kg/m2/year			1344.7871 (272)
Emissions per m2 for space and water heating			16.3141 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3411 (272b)
Emissions per m2 for pumps and fans			0.5561 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3141 * 1.00) + 2.3411 + 0.5561, rounded to 2 d.p.			19.2100 (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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1132 (8)
Pressure test					Yes
Measured/design AP50					4.0900
Infiltration rate					0.3177 (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) =	0.2700 (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	0.3443	0.3375	0.3308	0.2970	0.2903	0.2565	0.2565	0.2498	0.2700	0.2903	0.3038	0.3173 (22b)
Effective ac	0.5593	0.5570	0.5547	0.5441	0.5421	0.5329	0.5329	0.5312	0.5365	0.5421	0.5461	0.5503 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2146		(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss							(33) + (36) = 53.2240 (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	32.6200	32.4858	32.3543	31.7364	31.6208	31.0826	31.0826	30.9829	31.2899	31.6208	31.8546	32.0991 (38)
Heat transfer coeff	85.8441	85.7099	85.5783	84.9604	84.8448	84.3066	84.3066	84.2070	84.5139	84.8448	85.0787	85.3232 (39)
Average = Sum(39)m / 12 =												84.9599 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2263	1.2244	1.2225	1.2137	1.2121	1.2044	1.2044	1.2030	1.2073	1.2121	1.2154	1.2189 (40)
HLP (average)												1.2137 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)											Total = Sum(45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF 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 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8792	15.8802	12.9146	9.7772	7.3086	6.1702	6.6671	8.6662	11.6317	14.7691	17.2378	18.3761	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
Total internal gains	312.6573	311.4132	300.6046	282.8351	264.1332	246.6286	235.5852	239.1694	248.5848	266.4821	287.0795	303.1620	(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				2.4500	10.6334	0.4500	0.0000		0.7700	9.0270 (74)		
East				6.3500	19.6403	0.4500	0.0000		0.7700	43.2140 (76)		
West				4.2000	19.6403	0.4500	0.0000		0.7700	28.5825 (80)		
Solar gains	80.8234	157.7001	260.6133	384.4219	476.8469	491.1094	466.3059	396.3903	304.2555	187.1897	100.6576	66.5672 (83)
Total gains	393.4808	469.1132	561.2178	667.2570	740.9800	737.7380	701.8911	635.5598	552.8404	453.6718	387.7371	369.7292 (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	56.0857	56.1735	56.2599	56.6690	56.7463	57.1085	57.1085	57.1761	56.9684	56.7463	56.5903	56.4281	
alpha	4.7390	4.7449	4.7507	4.7779	4.7831	4.8072	4.8072	4.8117	4.7979	4.7831	4.7727	4.7619	
util living area	0.9984	0.9960	0.9872	0.9515	0.8520	0.6792	0.5166	0.5862	0.8488	0.9794	0.9967	0.9988	(86)
MIT	19.6125	19.7828	20.0837	20.4747	20.7892	20.9485	20.9888	20.9802	20.8477	20.4145	19.9365	19.5794	(87)
Th 2	19.8990	19.9005	19.9020	19.9090	19.9104	19.9165	19.9165	19.9176	19.9141	19.9104	19.9077	19.9049	(88)
util rest of house	0.9979	0.9947	0.9826	0.9335	0.8006	0.5846	0.3955	0.4597	0.7754	0.9687	0.9953	0.9984	(89)
MIT 2	18.6372	18.8081	19.1076	19.4915	19.7722	19.8938	19.9138	19.9122	19.8303	19.4419	18.9676	18.6088	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	18.8211	18.9919	19.2916	19.6769	19.9639	20.0927	20.1165	20.1136	20.0221	19.6253	19.1503	18.7919	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8211	18.9919	19.2916	19.6769	19.9639	20.0927	20.1165	20.1136	20.0221	19.6253	19.1503	18.7919	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9971	0.9931	0.9792	0.9287	0.8035	0.6010	0.4185	0.4837	0.7840	0.9650	0.9940	0.9978	(94)
Ext temp.	392.3391	465.8713	549.5249	619.7057	595.3541	443.3750	293.7282	307.3889	433.4061	437.7838	385.4017	368.9269	(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	1246.5512	1207.8177	1094.6874	915.6101	701.1529	463.0689	296.4647	312.7100	500.5015	765.7519	1025.2255	1245.0233	(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	635.5338	498.5880	405.6009	213.0511	78.7143	0.0000	0.0000	0.0000	0.0000	244.0083	460.6731	651.8158	(98)
Space heating per m2												3187.9852	(98)
										(98) / (4) =		45.5426	(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	792.4823	623.8691	639.9730	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8921	0.9407	0.9147	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	706.9801	586.8604	585.3818	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	945.8483	902.2715	826.1265	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	171.9851	234.6659	179.1140	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												585.7650 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	42.9963	58.6665	44.7785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												146.4413 (107)
Space cooling per m2												2.0920 (108)
Energy for space heating												45.5426 (99)
Energy for space cooling												2.0920 (108)
Total												47.6347 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1132 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3632 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3087 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3936	0.3859	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3473	0.3627 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000		(26)					
TER Opening Type (Uw = 1.40)			13.0000	1.3258	17.2348		(27)					
ground			35.0000	0.1300	4.5500		(28a)					
external	84.8400	15.1000	69.7400	0.1800	12.5532		(29a)					
cd	35.0000		35.0000	0.1300	4.5500		(30)					
Total net area of external elements Aum(A, m2)			154.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9880		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7810 (36)					
Total fabric heat loss						(33) + (36) =	49.7690 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.6811	33.5057	33.3337	32.5261	32.3750	31.6717	31.6717	31.5414	31.9426	32.3750	32.6807	33.0003 (38)
Heat transfer coeff	83.4501	83.2747	83.1028	82.2952	82.1441	81.4407	81.4407	81.3104	81.7116	82.1441	82.4498	82.7693 (39)
Average = Sum(39)m / 12 =												82.2945 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1921	1.1896	1.1872	1.1756	1.1735	1.1634	1.1634	1.1616	1.1673	1.1735	1.1779	1.1824 (40)
HLP (average)												1.1756 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.8792	15.8802	12.9146	9.7772	7.3086	6.1702	6.6671	8.6662	11.6317	14.7691	17.2378	18.3761 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Pumps, fans	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Total internal gains	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021 (72)
	312.6573	311.4132	300.6046	282.8351	264.1332	246.6286	235.5852	239.1694	248.5848	266.4821	287.0795	303.1620 (73)

6. Solar gains												

[Jan]				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North				2.4500	10.6334		0.6300		0.7000		0.7700	7.9618 (74)
East				6.3500	19.6403		0.6300		0.7000		0.7700	38.1147 (76)
West				4.2000	19.6403		0.6300		0.7000		0.7700	25.2097 (80)

Solar gains	71.2862	139.0915	229.8609	339.0601	420.5790	433.1585	411.2818	349.6163	268.3534	165.1013	88.7800	58.7123 (83)
Total gains	383.9436	450.5046	530.4655	621.8953	684.7121	679.7871	646.8670	588.7857	516.9382	431.5834	375.8595	361.8743 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	58.2517	58.3744	58.4952	59.0692	59.1779	59.6890	59.6890	59.7846	59.4911	59.1779	58.9585	58.7308
util living area	4.8834	4.8916	4.8997	4.9379	4.9452	4.9793	4.9793	4.9856	4.9661	4.9452	4.9306	4.9154
	0.9987	0.9968	0.9899	0.9609	0.8739	0.7068	0.5405	0.6094	0.8663	0.9828	0.9972	0.9990 (86)
MIT	19.6550	19.8123	20.0939	20.4682	20.7788	20.9455	20.9884	20.9796	20.8449	20.4254	19.9705	19.6275 (87)
Th 2	19.9263	19.9283	19.9303	19.9395	19.9413	19.9494	19.9494	19.9509	19.9462	19.9413	19.9378	19.9341 (88)
util rest of house	0.9982	0.9957	0.9861	0.9457	0.8270	0.6139	0.4184	0.4831	0.7979	0.9737	0.9961	0.9987 (89)
MIT 2	18.7003	18.8588	19.1400	19.5117	19.7934	19.9248	19.9465	19.9451	19.8590	19.4776	19.0246	18.6791 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8804	19.0386	19.3199	19.6921	19.9792	20.1173	20.1429	20.1402	20.0449	19.6563	19.2030	18.8580 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8804	19.0386	19.3199	19.6921	19.9792	20.1173	20.1429	20.1402	20.0449	19.6563	19.2030	18.8580 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9975	0.9944	0.9832	0.9413	0.8290	0.6299	0.4416	0.5071	0.8055	0.9704	0.9949	0.9982 (94)
Ext temp.	383.0020	447.9644	521.5785	585.4139	567.6031	428.1647	285.6469	298.5546	416.3847	418.8127	373.9530	361.2096 (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	1216.7340	1177.3859	1065.3702	888.1380	680.0879	449.3306	288.5401	304.1184	485.7683	743.9219	997.8859	1213.2300 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	620.2966	490.1712	404.5810	217.9614	83.6887	0.0000	0.0000	0.0000	0.0000	241.8813	449.2317	633.9032 (98)
Space heating												3141.7150 (98)
Space heating per m2												(98) / (4) = 44.8816 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	765.5426	602.6612	617.9594	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8843	0.9368	0.9104	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	676.9866	564.5670	562.6117	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	878.1135	837.9576	771.4555	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)
	0.0000	0.0000	0.0000	0.0000	0.0000	144.8113	203.4026	155.3798	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												503.5938 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	36.2028	50.8507	38.8450	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												125.8984 (107)
Space cooling per m2												1.7985 (108)
Energy for space heating												44.8816 (99)
Energy for space cooling												1.7985 (108)
Total												46.6802 (109)
Target Fabric Energy Efficiency (TFEE)												53.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0900
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2146			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	53.2240 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878 (39)
Average = Sum(39)m / 12 =												82.3878 (39)
HLP	Jan 1.1770	Feb 1.1770	Mar 1.1770	Apr 1.1770	May 1.1770	Jun 1.1770	Jul 1.1770	Aug 1.1770	Sep 1.1770	Oct 1.1770	Nov 1.1770	Dec 1.1770 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
RHI water heating demand												1542 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6981	39.7004	32.2866	24.4430	18.2714	15.4255	16.6678	21.6654	29.0793	36.9229	43.0944	45.9404 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	506.3732	502.4015	483.0772	453.1190	422.5388	395.0147	378.8216	386.4583	403.5978	433.7559	467.3076	492.6052 (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				2.4500	13.4684		0.4500		0.0000		0.7700	11.4337 (74)
East				6.3500	25.1733		0.4500		0.0000		0.7700	55.3881 (76)
West				4.2000	25.1733		0.4500		0.0000		0.7700	36.6346 (80)
Solar gains	103.4564	171.9565	288.9237	426.1818	495.6551	563.9303	514.8175	457.9812	352.6197	220.2138	128.4747	80.6212 (83)
Total gains	609.8295	674.3580	772.0009	879.3008	918.1940	958.9450	893.6392	844.4394	756.2175	653.9698	595.7823	573.2264 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386
alpha	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959
util living area	0.9854	0.9759	0.9406	0.8390	0.6648	0.4338	0.3036	0.3115	0.5877	0.8742	0.9690	0.9884 (86)
MIT	20.1016	20.2229	20.4917	20.7844	20.9456	20.9944	20.9992	20.9992	20.9772	20.7826	20.4023	20.0665 (87)
Th 2	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385 (88)
util rest of house	0.9806	0.9682	0.9221	0.7949	0.5906	0.3457	0.2063	0.2086	0.4864	0.8251	0.9569	0.9844 (89)
MIT 2	19.1538	19.2719	19.5286	19.7883	19.9101	19.9368	19.9384	19.9384	19.9303	19.7956	19.4488	19.1195 (90)
Living area fraction	19.3325	19.4513	19.7102	19.9762	20.1053	20.1362	20.1384	20.1384	20.1277	19.9817	19.6286	19.2981 (92)
MIT	19.3325	19.4513	19.7102	19.9762	20.1053	20.1362	20.1384	20.1384	20.1277	19.9817	19.6286	19.2981 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1825	19.3013	19.5602	19.8262	19.9553	19.9862	19.9884	19.9884	19.9777	19.8317	19.4786	19.1481 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	595.2140	648.8250	705.6471	694.3466	543.4432	335.3550	188.4657	180.2251	370.7686	535.7926	566.0543	562.0124 (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	1119.0341	1095.8614	985.3752	801.3175	564.7960	336.6569	188.5388	180.2990	377.1452	637.0016	896.2608	1107.9587 (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	389.7222	300.4085	208.1177	77.0190	15.8865	0.0000	0.0000	0.0000	0.0000	75.2995	237.7487	406.1840 (98)
Space heating												1710.3860 (98)
RHI space heating demand												1710 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.2146		(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	53.2240 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878 (39)
Average = Sum(39)m / 12 =												82.3878 (39)
HLP	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum (45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)
										Total per year (kWh/year) =	Sum (64)m =	1542.3261 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6981	39.7004	32.2866	24.4430	18.2714	15.4255	16.6678	21.6654	29.0793	36.9229	43.0944	45.9404 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	506.3732	502.4015	483.0772	453.1190	422.5388	395.0147	378.8216	386.4583	403.5978	433.7559	467.3076	492.6052 (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				2.4500	10.6334	0.4500	0.0000	0.7700	9.0270 (74)			
East				6.3500	19.6403	0.4500	0.0000	0.7700	43.2140 (76)			
West				4.2000	19.6403	0.4500	0.0000	0.7700	28.5825 (80)			
Solar gains	80.8234	157.7001	260.6133	384.4219	476.8469	491.1094	466.3059	396.3903	304.2555	187.1897	100.6576	66.5672 (83)
Total gains	587.1966	660.1016	743.6905	837.5409	899.3857	886.1240	845.1275	782.8486	707.8533	620.9456	567.9653	559.1724 (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	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386
alpha	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959
util living area	0.9911	0.9832	0.9605	0.8939	0.7578	0.5751	0.4250	0.4768	0.7286	0.9331	0.9835	0.9929 (86)
MIT	19.9320	20.0887	20.3539	20.6660	20.8861	20.9763	20.9956	20.9924	20.9291	20.6268	20.2109	19.8849 (87)
Th 2	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385 (88)
util rest of house	0.9883	0.9780	0.9483	0.8627	0.6970	0.4881	0.3246	0.3705	0.6429	0.9058	0.9774	0.9907 (89)
MIT 2	18.9859	19.1403	19.3977	19.6870	19.8687	19.9287	19.9374	19.9365	19.9036	19.6601	19.2623	18.9394 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.1643	19.3191	19.5781	19.8716	20.0606	20.1262	20.1370	20.1356	20.0970	19.8424	19.4412	19.1177 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0143	19.1691	19.4281	19.7216	19.9106	19.9762	19.9870	19.9856	19.9470	19.6924	19.2912	18.9677 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9850	0.9731	0.9409	0.8553	0.6953	0.4913	0.3292	0.3754	0.6437	0.8980	0.9724	0.9879 (94)
Useful gains	578.3681	642.3546	699.7411	716.3114	625.3507	435.3768	278.2209	293.8480	455.6423	557.5974	552.2794	552.3846 (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	1212.2799	1175.6004	1065.1136	891.5715	676.4515	442.9337	279.0453	295.4106	481.7203	749.1045	1004.4062	1216.6769 (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	471.6304	358.3412	271.8371	126.1873	38.0190	0.0000	0.0000	0.0000	0.0000	142.4813	325.5312	494.2335 (98)
Space heating												2228.2610 (98)
Space heating per m ²										(98) / (4) =		31.8323 (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													2462.1668	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	471.6304	358.3412	271.8371	126.1873	38.0190	0.0000	0.0000	0.0000	0.0000	142.4813	325.5312	494.2335	(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)	521.1386	395.9571	300.3725	139.4334	42.0099	0.0000	0.0000	0.0000	0.0000	157.4379	359.7030	546.1143	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)	
Efficiency of water heater	89.6794	89.5888	89.3712	88.8729	88.0406	87.3000	87.3000	87.3000	87.3000	88.9404	89.5086	87.3000	(216)	
(217)m	89.6794	89.5888	89.3712	88.8729	88.0406	87.3000	87.3000	87.3000	87.3000	88.9404	89.5086	89.7249	(217)	
Fuel for water heating, kWh/month	174.9529	153.5974	159.9186	141.6766	138.3331	122.0263	114.7023	129.3075	130.1650	146.9312	157.4773	169.8304	(219)	
Water heating fuel used												1738.9186	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2462.1668	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)												47.3439	(230a)	
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												122.3439	(231)	
Electricity for lighting (calculated in Appendix L)												315.7527	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =											-537.4497	-537.4497	(233)	
Total delivered energy for all uses												4101.7322	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2462.1668	3.4800	85.6834	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1738.9186	3.4800	60.5144	(247)
Mechanical ventilation fans	47.3439	13.1900	6.2447	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	315.7527	13.1900	41.6478	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			253.0931	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9243	(257)
SAP value		87.1055	
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	2462.1668	0.2160	531.8280	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1738.9186	0.2160	375.6064	(264)
Space and water heating			907.4344	(265)
Pumps and fans	122.3439	0.5190	63.4965	(267)
Energy for lighting	315.7527	0.5190	163.8756	(268)
Energy saving/generation technologies				
PV Unit	-537.4497	0.5190	-278.9364	(269)
Total kg/year			855.8702	(272)
CO2 emissions per m2			12.2300	(273)
EI value			90.0273	
EI rating			90	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8858 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8858 = 0.2439$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0900
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2146			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	53.2240 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878 (39)
Average = Sum(39)m / 12 =												82.3878 (39)
HLP	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum(45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month												
	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
										Solar input (sum of months) =	Sum(63)m =	0.0000 (63)
Output from w/h	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
										Total per year (kWh/year) =	Sum(64)m =	1542.3261 (64)
Heat gains from water heating, kWh/month												
	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	44.6981	39.7004	32.2866	24.4430	18.2714	15.4255	16.6678	21.6654	29.0793	36.9229	43.0944	45.9404 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)												
	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	506.3732	502.4015	483.0772	453.1190	422.5388	395.0147	378.8216	386.4583	403.5978	433.7559	467.3076	492.6052 (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				2.4500	13.4684	0.4500	0.0000	0.7700	11.4337 (74)			
East				6.3500	25.1733	0.4500	0.0000	0.7700	55.3881 (76)			
West				4.2000	25.1733	0.4500	0.0000	0.7700	36.6346 (80)			
Solar gains	103.4564	171.9565	288.9237	426.1818	495.6551	563.9303	514.8175	457.9812	352.6197	220.2138	128.4747	80.6212 (83)
Total gains	609.8295	674.3580	772.0009	879.3008	918.1940	958.9450	893.6392	844.4394	756.2175	653.9698	595.7823	573.2264 (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	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386
alpha	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959
util living area	0.9854	0.9759	0.9406	0.8390	0.6648	0.4338	0.3036	0.3115	0.5877	0.8742	0.9690	0.9884 (86)
MIT	20.1016	20.2229	20.4917	20.7844	20.9456	20.9944	20.9992	20.9992	20.9772	20.7826	20.4023	20.0665 (87)
Th 2	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385 (88)
util rest of house												
	0.9806	0.9682	0.9221	0.7949	0.5906	0.3457	0.2063	0.2086	0.4864	0.8251	0.9569	0.9844 (89)
MIT 2	19.1538	19.2719	19.5286	19.7883	19.9101	19.9368	19.9384	19.9384	19.9303	19.7956	19.4488	19.1195 (90)
Living area fraction									fLA =	Living area / (4) =		0.1886 (91)
MIT	19.3325	19.4513	19.7102	19.9762	20.1053	20.1362	20.1384	20.1384	20.1277	19.9817	19.6286	19.2981 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1825	19.3013	19.5602	19.8262	19.9553	19.9862	19.9884	19.9884	19.9777	19.8317	19.4786	19.1481 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9760	0.9621	0.9140	0.7897	0.5919	0.3497	0.2109	0.2134	0.4903	0.8193	0.9501	0.9804 (94)
Useful gains	595.2140	648.8250	705.6471	694.3466	543.4432	335.3550	188.4657	180.2251	370.7686	535.7926	566.0543	562.0124 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	18.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W												
	1119.0341	1095.8614	985.3752	801.3175	564.7960	336.6569	188.5388	180.2990	377.1452	637.0016	896.2608	1107.9587 (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												
	389.7222	300.4085	208.1177	77.0190	15.8865	0.0000	0.0000	0.0000	0.0000	75.2995	237.7487	406.1840 (98)
Space heating												1710.3860 (98)
Space heating per m2										(98) / (4) =		24.4341 (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 1889.9293 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	389.7222	300.4085	208.1177	77.0190	15.8865	0.0000	0.0000	0.0000	0.0000	75.2995	237.7487	406.1840	(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)	430.6322	331.9431	229.9643	85.1039	17.5541	0.0000	0.0000	0.0000	0.0000	83.2039	262.7057	448.8221	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater (217)m	89.5577	89.4697	89.1693	88.4875	87.6577	87.3000	87.3000	87.3000	87.3000	88.4432	89.2819	87.3000	(216)
Fuel for water heating, kWh/month	175.1906	153.8019	160.2807	142.2937	138.9374	122.0263	114.7023	129.3075	130.1650	147.7571	157.8772	170.0596	(219)
Water heating fuel used												1742.3994	(219)
Annual totals kWh/year													
Space heating fuel - main system												1889.9293	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)
 mechanical ventilation fans (SFP = 0.2196) 47.3439 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 122.3439 (231)
 Electricity for lighting (calculated in Appendix L) 315.7527 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV Unit 0 (0.80 * 0.74 * 1030 * 1.00) = -609.7952 -609.7952 (233)
 Total delivered energy for all uses 3460.6301 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1889.9293	10.2300	193.3398	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1742.3994	10.2300	178.2475	(247)
Mechanical ventilation fans	47.3439	36.7200	17.3847	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	315.7527	36.7200	115.9444	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			411.5395	(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	1889.9293	0.2160	408.2247	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1742.3994	0.2160	376.3583	(264)
Space and water heating			784.5830	(265)
Pumps and fans	122.3439	0.5190	63.4965	(267)
Energy for lighting	315.7527	0.5190	163.8756	(268)
Energy saving/generation technologies				
PV Unit	-609.7952	0.5190	-316.4837	(269)
Total kg/year			695.4714	(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	1889.9293	1.2200	2305.7138	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1742.3994	1.2200	2125.7273	(264)
Space and water heating			4431.4410	(265)
Pumps and fans	122.3439	3.0700	375.5957	(267)
Energy for lighting	315.7527	3.0700	969.3607	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			3904.3263 (272)
Primary energy kWh/m2/year			55.7761 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E	Low energy lighting
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Already installed
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 78	-179 kg (25.7%)

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

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£161	£179	-£18
Mains gas	£475	£378	£97
Space heating	£341	£341	£0
Water heating	£178	£100	£78
Lighting	£116	£116	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£412	£333	£79
Total cost of uses	£411	£333	£78
Delivered energy	49 kWh/m²	37 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	3 kg/m²
Primary energy	56 kWh/m²	41 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)		
Pressure test														Yes			
Measured/design AP50														4.0900			
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2146			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	53.2240 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878 (39)
Average = Sum(39)m / 12 =												82.3878 (39)
HLP	Jan 1.1770	Feb 1.1770	Mar 1.1770	Apr 1.1770	May 1.1770	Jun 1.1770	Jul 1.1770	Aug 1.1770	Sep 1.1770	Oct 1.1770	Nov 1.1770	Dec 1.1770 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3167 (H8)
Utilisation factor												0.5321 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.5455 (H14)
Volume ratio Veff/V												0.8567 (H15)
Solar storage volume factor												0.9691 (H16)
Solar input												-822.2846 (H17)
Solar input	-23.8446	-39.7898	-67.7666	-90.8206	-112.2012	-110.3117	-108.8538	-95.1061	-74.4872	-50.8660	-28.2831	-19.9539 (63)
Solar input (sum of months) = Sum (63)m =												-822.2846 (63)
Output from w/h	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263 (64)
Total per year (kWh/year) = Sum (64)m =												732.5429 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6981	39.7004	32.2866	24.4430	18.2714	15.4255	16.6678	21.6654	29.0793	36.9229	43.0944	45.9404	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392	(72)
Total internal gains	506.3732	502.4015	483.0772	453.1190	422.5388	395.0147	378.8216	386.4583	403.5978	433.7559	467.3076	492.6052	(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				2.4500	10.6334	0.4500		0.0000	0.7700	9.0270 (74)		
East				6.3500	19.6403	0.4500		0.0000	0.7700	43.2140 (76)		
West				4.2000	19.6403	0.4500		0.0000	0.7700	28.5825 (80)		
Solar gains	80.8234	157.7001	260.6133	384.4219	476.8469	491.1094	466.3059	396.3903	304.2555	187.1897	100.6576	66.5672 (83)
Total gains	587.1966	660.1016	743.6905	837.5409	899.3857	886.1240	845.1275	782.8486	707.8533	620.9456	567.9653	559.1724 (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	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386
alpha	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959
util living area	0.9911	0.9832	0.9605	0.8939	0.7578	0.5751	0.4250	0.4768	0.7286	0.9331	0.9835	0.9929 (86)
MIT	19.9320	20.0887	20.3539	20.6660	20.8861	20.9763	20.9956	20.9924	20.9291	20.6268	20.2109	19.8849 (87)
Th 2	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385 (88)
util rest of house	0.9883	0.9780	0.9483	0.8627	0.6970	0.4881	0.3246	0.3705	0.6429	0.9058	0.9774	0.9907 (89)
MIT 2	18.9859	19.1403	19.3977	19.6870	19.8687	19.9287	19.9374	19.9365	19.9036	19.6601	19.2623	18.9394 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.1643	19.3191	19.5781	19.8716	20.0606	20.1262	20.1370	20.1356	20.0970	19.8424	19.4412	19.1177 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0143	19.1691	19.4281	19.7216	19.9106	19.9762	19.9870	19.9856	19.9470	19.6924	19.2912	18.9677 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9850	0.9731	0.9409	0.8553	0.6953	0.4913	0.3292	0.3754	0.6437	0.8980	0.9724	0.9879	(94)
Useful gains	578.3681	642.3546	699.7411	716.3114	625.3507	435.3768	278.2209	293.8480	455.6423	557.5974	552.2794	552.3846	(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	1212.2799	1175.6004	1065.1136	891.5715	676.4515	442.9337	279.0453	295.4106	481.7203	749.1045	1004.4062	1216.6769	(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	471.6304	358.3412	271.8371	126.1873	38.0190	0.0000	0.0000	0.0000	0.0000	142.4813	325.5312	494.2335	(98)
Space heating												2228.2610	(98)
Space heating per m2											(98) / (4) =	31.8323	(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													2462.1668	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	471.6304	358.3412	271.8371	126.1873	38.0190	0.0000	0.0000	0.0000	0.0000	142.4813	325.5312	494.2335	(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)	521.1386	395.9571	300.3725	139.4334	42.0099	0.0000	0.0000	0.0000	0.0000	157.4379	359.7030	546.1143	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263	(64)	
Efficiency of water heater	89.7759	89.7942	89.7872	89.7839	89.8368	87.3000	87.3000	87.3000	87.3000	89.3244	89.6550	87.3000	(216)	
(217)m	89.7759	89.7942	89.7872	89.7839	89.8368	87.3000	87.3000	87.3000	87.3000	89.3244	89.6550	89.8044	(217)	
Fuel for water heating, kWh/month	148.2047	108.9339	83.7030	39.0845	10.6728	0.0000	0.0000	20.3658	44.8418	89.3542	125.6736	147.4609	(219)	
Water heating fuel used												818.2950	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2462.1668	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)													47.3439	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													172.3439	(231)
Electricity for lighting (calculated in Appendix L)													315.7527	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =										-537.4497			-537.4497	(233)
Total delivered energy for all uses													3231.1087	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2462.1668	3.4800	85.6834	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	818.2950	3.4800	28.4767	(247)
Mechanical ventilation fans	47.3439	13.1900	6.2447	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	315.7527	13.1900	41.6478	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			227.6504	(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] =	0.8314	(257)
SAP value		88.4017	
SAP rating (Section 12)		88	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2462.1668	0.2160	531.8280 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	818.2950	0.2160	176.7517 (264)
Space and water heating			708.5798 (265)
Pumps and fans	172.3439	0.5190	89.4465 (267)
Energy for lighting	315.7527	0.5190	163.8756 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			682.9655 (272)
CO2 emissions per m2			9.7600 (273)
EI value			92.0420
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0900
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	15.1000	69.7400	0.2700	18.8298	150.0000	10460.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2146			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17332.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.6093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	53.2240 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878	82.3878 (39)
Average = Sum(39)m / 12 =												82.3878 (39)
HLP	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770	1.1770 (40)
HLP (average)												1.1770 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4709 (H8)
Utilisation factor												0.4933 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.5455 (H14)
Volume ratio Veff/V												0.8567 (H15)
Solar storage volume factor												0.9691 (H16)
Solar input												-851.6522 (H17)
Solar input	-27.7905	-39.5212	-68.5795	-92.2510	-107.2019	-116.6045	-110.5589	-100.8190	-78.9108	-54.5403	-32.8698	-22.0049 (63)
Solar input (sum of months) = Sum (63)m =												-851.6522 (63)
Output from w/h	129.1063	98.0849	74.3417	33.6612	14.5874	0.0000	0.0000	12.0665	34.7233	76.1408	108.0859	130.3753 (64)
Total per year (kWh/year) = Sum (64)m =												711.1732 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.6981	39.7004	32.2866	24.4430	18.2714	15.4255	16.6678	21.6654	29.0793	36.9229	43.0944	45.9404	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392	(72)
Total internal gains	506.3732	502.4015	483.0772	453.1190	422.5388	395.0147	378.8216	386.4583	403.5978	433.7559	467.3076	492.6052	(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				2.4500	13.4684		0.4500		0.0000		0.7700		11.4337 (74)
East				6.3500	25.1733		0.4500		0.0000		0.7700		55.3881 (76)
West				4.2000	25.1733		0.4500		0.0000		0.7700		36.6346 (80)
Solar gains	103.4564	171.9565	288.9237	426.1818	495.6551	563.9303	514.8175	457.9812	352.6197	220.2138	128.4747		80.6212 (83)
Total gains	609.8295	674.3580	772.0009	879.3008	918.1940	958.9450	893.6392	844.4394	756.2175	653.9698	595.7823	573.2264	(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	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386	58.4386
alpha	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959	4.8959
util living area	0.9854	0.9759	0.9406	0.8390	0.6648	0.4338	0.3036	0.3115	0.5877	0.8742	0.9690	0.9884 (86)
MIT	20.1016	20.2229	20.4917	20.7844	20.9456	20.9944	20.9992	20.9992	20.9772	20.7826	20.4023	20.0665 (87)
Th 2	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385	19.9385 (88)
util rest of house	0.9806	0.9682	0.9221	0.7949	0.5906	0.3457	0.2063	0.2086	0.4864	0.8251	0.9569	0.9844 (89)
MIT 2	19.1538	19.2719	19.5286	19.7883	19.9101	19.9368	19.9384	19.9384	19.9303	19.7956	19.4488	19.1195 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.3325	19.4513	19.7102	19.9762	20.1053	20.1362	20.1384	20.1384	20.1277	19.9817	19.6286	19.2981 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1825	19.3013	19.5602	19.8262	19.9553	19.9862	19.9884	19.9884	19.9777	19.8317	19.4786	19.1481 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9760	0.9621	0.9140	0.7897	0.5919	0.3497	0.2109	0.2134	0.4903	0.8193	0.9501	0.9804	(94)
Useful gains	595.2140	648.8250	705.6471	694.3466	543.4432	335.3550	188.4657	180.2251	370.7686	535.7926	566.0543	562.0124	(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	1119.0341	1095.8614	985.3752	801.3175	564.7960	336.6569	188.5388	180.2990	377.1452	637.0016	896.2608	1107.9587	(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	389.7222	300.4085	208.1177	77.0190	15.8865	0.0000	0.0000	0.0000	0.0000	75.2995	237.7487	406.1840	(98)
Space heating												1710.3860	(98)
Space heating per m2											(98) / (4) =	24.4341	(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													1889.9293 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	389.7222	300.4085	208.1177	77.0190	15.8865	0.0000	0.0000	0.0000	0.0000	75.2995	237.7487	406.1840	(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)	430.6322	331.9431	229.9643	85.1039	17.5541	0.0000	0.0000	0.0000	0.0000	83.2039	262.7057	448.8221	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	129.1063	98.0849	74.3417	33.6612	14.5874	0.0000	0.0000	12.0665	34.7233	76.1408	108.0859	130.3753	(64)
Efficiency of water heater	(217)m	89.6820	89.6352	89.5022	88.9394	87.3000	87.3000	87.3000	87.3000	88.8623	89.4750	87.3000	(216)
Fuel for water heating, kWh/month	143.9601	109.3590	82.9380	37.6093	16.4015	0.0000	0.0000	13.8219	39.7746	85.6840	120.8002	145.3441	(219)
Water heating fuel used												795.6928	(219)
Annual totals kWh/year													
Space heating fuel - main system												1889.9293	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													47.3439 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													172.3439 (231)
Electricity for lighting (calculated in Appendix L)													315.7527 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.74 * 1030 * 1.00) =										-609.7952		-609.7952	(233)
Total delivered energy for all uses												2563.9235	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1889.9293	10.2300	193.3398	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	795.6928	10.2300	81.3994	(247)
Mechanical ventilation fans	47.3439	36.7200	17.3847	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	315.7527	36.7200	115.9444	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			333.0514	(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	1889.9293	0.2160	408.2247	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	795.6928	0.2160	171.8696	(264)
Space and water heating			580.0944	(265)
Pumps and fans	172.3439	0.5190	89.4465	(267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	315.7527	0.5190	163.8756 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			516.9328 (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	1889.9293	1.2200	2305.7138 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	795.6928	1.2200	970.7452 (264)
Space and water heating			3276.4589 (265)
Pumps and fans	172.3439	3.0700	529.0957 (267)
Energy for lighting	315.7527	3.0700	969.3607 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			2902.8442 (272)
Primary energy kWh/m2/year			41.4692 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	247.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	233.31 (P1)
Transmission heat loss coefficient	53.22 (37)
Summer heat loss coefficient	286.53 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	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)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.4500	87.1704	0.4500	0.0000	0.9000	86.4949
East	6.3500	125.2818	0.4500	0.0000	0.9000	322.1934
West	4.2000	125.2818	0.4500	0.0000	0.9000	213.1043
total:						621.7926

	Jun	Jul	Aug	
Solar gains	671	622	541	(P4)
Internal gains	392	376	383	
Total summer gains	1063	998	925	(P5)
Summer gain/loss ratio	3.71	3.48	3.23	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 247.6)	0.27	0.27	0.27	
Threshold temperature	19.38	21.05	20.79	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 70	Issued on Date	27/11/2023
Assessment Reference	21809 plot 70	Prop Type Ref	21809
Property	2 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	14.28
Environmental	90 B	TER	19.21
CO ₂ Emissions (t/year)	0.70	% DER<TER	25.67
General Requirements Compliance	Pass	DfEE	47.63
		TfEE	53.68
		% DfEE<TfEE	11.27
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.21	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.28	kgCO ₂ /m ²	Pass
	-4.93 (-25.7%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	53.68	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	47.63	kWh/m ² /yr	
	-6.1 (-11.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.09 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

2.45 m², No overhang

Windows facing East

6.35 m², No overhang

Windows facing West

4.20 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.09 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

0.74

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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