

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 88			Issued on Date	10/08/2023
Assessment Reference	88 Hamble	Prop Type Ref	21809		
Property	6 Hickory Way, Hedge End, Southampton, SO30 0AW				
SAP Rating	87 B	DER	14.29	TER	19.31
Environmental	90 B	% DER<TER	25.99		
CO ₂ Emissions (t/year)	0.70	DFEE	48.01	TFEE	53.38
General Requirements Compliance	Pass	% DFEE<TFEE	10.06		
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

End-Terrace 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) 19.31 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (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:	4.67 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power:	0.1600 0.1800	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:	Average
Windows facing East:	7.05 m ² , No overhang
Windows facing South:	0.65 m ² , No overhang
Windows facing West:	4.20 m ² , No overhang
Air change rate:	0.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Floor U-value	0.12 W/m ² K
Door U-value	1.00 W/m ² K
Photovoltaic array	0.74 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												4.6700
Infiltration rate												0.2335 (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) =	0.1985 (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												
	0.2531	0.2481	0.2431	0.2183	0.2134	0.1886	0.1886	0.1836	0.1985	0.2134	0.2233	0.2332 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5031	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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533			(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) =	17497.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.9664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9863 (36)
Total fabric heat loss						(33) + (36) =	52.0396 (37)

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

(38)m	Jan 29.3420	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	81.3816	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034 (39)
Average = Sum(39)m / 12 =												81.2182 (39)
HLP	Jan 1.1626	Feb 1.1600	Mar 1.1600	Apr 1.1600	May 1.1600	Jun 1.1600	Jul 1.1600	Aug 1.1600	Sep 1.1600	Oct 1.1600	Nov 1.1600	Dec 1.1600 (40)
HLP (average)												1.1603 (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)
								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								Total per year (kWh/year) =	Sum(64)m =			1542.3261 (64)
	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												
	18.1409	16.1126	13.1036	9.9203	7.4155	6.2605	6.7647	8.7930	11.8020	14.9853	17.4901	18.6451 (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												
	343.6863	341.6756	329.2973	309.4090	289.3245	269.9092	257.2658	262.9415	273.1350	293.2232	316.2793	333.4679 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East				7.0500	19.6403	0.4500	0.0000			0.7700			47.9777 (76)
South				0.6500	46.7521	0.4500	0.0000			0.7700			10.5297 (78)
West				4.2000	19.6403	0.4500	0.0000			0.7700			28.5825 (80)
Solar gains	87.0899	167.0130	268.6136	384.5468	466.7213	476.1860	453.9715	392.6831	309.8073	196.3127	107.9429	72.0580	(83)
Total gains	430.7762	508.6886	597.9109	693.9559	756.0458	746.0953	711.2373	655.6246	582.9423	489.5359	424.2222	405.5259	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.7243	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554
alpha	4.9816	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904
util living area												
	0.9978	0.9945	0.9830	0.9408	0.8326	0.6573	0.4942	0.5544	0.8161	0.9712	0.9953	0.9983 (86)
MIT	19.7560	19.9265	20.2102	20.5585	20.8316	20.9607	20.9922	20.9865	20.8868	20.5057	20.0537	19.7151 (87)
Th 2	19.9500	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521 (88)
util rest of house												
	0.9970	0.9926	0.9770	0.9200	0.7791	0.5654	0.3808	0.4358	0.7382	0.9572	0.9933	0.9978 (89)
MIT 2	18.8200	18.9913	19.2715	19.6052	19.8435	19.9350	19.9502	19.9485	19.8920	19.5626	19.1187	18.7808 (90)
Living area fraction									fLA =	Living area / (4) =		0.3943 (91)
MIT	19.1890	19.3601	19.6416	19.9811	20.2331	20.3395	20.3611	20.3578	20.2842	19.9344	19.4874	19.1492 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0390	19.2101	19.4916	19.8311	20.0831	20.1895	20.2111	20.2078	20.1342	19.7844	19.3374	18.9992 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9961	0.9908	0.9736	0.9172	0.7865	0.5873	0.4094	0.4657	0.7535	0.9543	0.9918	0.9971 (94)
Useful gains	429.0919	504.0209	582.1543	636.4685	594.6585	438.2018	291.1496	305.3211	439.2227	467.1608	420.7252	404.3362 (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												
	1199.4851	1162.0244	1054.9594	887.6386	680.7382	453.8830	293.2304	309.2038	489.9991	745.8064	993.7153	1201.7448 (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												
	573.1726	442.1784	351.7670	180.8425	64.0433	0.0000	0.0000	0.0000	0.0000	207.3124	412.5529	593.2720 (98)
Space heating												2825.1410 (98)
Space heating per m2										(98) / (4) =		40.3592 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3121.7028 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	573.1726	442.1784	351.7670	180.8425	64.0433	0.0000	0.0000	0.0000	0.0000	207.3124	412.5529	593.2720	(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)	633.3398	488.5949	388.6928	199.8260	70.7661	0.0000	0.0000	0.0000	0.0000	229.0745	455.8596	655.5492	(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	89.7927	89.7195	89.5516	89.1585	88.3769	87.3000	87.3000	87.3000	87.3000	89.2353	89.6630	87.3000	(216)
(217)m	89.7927	89.7195	89.5516	89.1585	88.3769	87.3000	87.3000	87.3000	87.3000	89.2353	89.6630	89.8271	(217)
Fuel for water heating, kWh/month	174.7323	153.3738	159.5963	141.2228	137.8066	122.0263	114.7023	129.3075	130.1650	146.4455	157.2061	169.6372	(219)
Water heating fuel used	174.7323	153.3738	159.5963	141.2228	137.8066	122.0263	114.7023	129.3075	130.1650	146.4455	157.2061	1736.2216	(219)
Annual totals kWh/year													
Space heating fuel - main system												3121.7028	(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)												320.3737	(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												4763.1923	(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	3121.7028	0.2160	674.2878	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1736.2216	0.2160	375.0239	(264)
Space and water heating			1049.3117	(265)
Pumps and fans	122.3439	0.5190	63.4965	(267)
Energy for lighting	320.3737	0.5190	166.2740	(268)
Energy saving/generation technologies				
PV Unit	-537.4497	0.5190	-278.9364	(269)
Total CO2, kg/year			1000.1457	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2900	(273)

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

DER			14.2900	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			33.4621	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			33.4621	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	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)				
Adj infilt rate	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)				
	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)			11.9000	1.3258	15.7765		(27)						
ground			35.0000	0.1300	4.5500		(28a)						
external	84.8400	14.0000	70.8400	0.1800	12.7512		(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) =		39.7277		(33)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6760 (36)						
Total fabric heat loss						(33) + (36) =	48.4037 (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	82.0848	81.9094	81.7375	80.9299	80.7788	80.0754	80.0754	79.9451	80.3463	80.7788	81.0844	81.4040 (39)	
Average = Sum(39)m / 12 =												80.9291 (39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1726	1.1701	1.1677	1.1561	1.1540	1.1439	1.1439	1.1421	1.1478	1.1540	1.1583	1.1629 (40)	
HLP (average)												1.1561 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	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	18.1409	16.1126	13.1036	9.9203	7.4155	6.2605	6.7647	8.7930	11.8020	14.9853	17.4901	18.6451	(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	355.4426	352.8397	339.8725	319.3971	298.7216	278.7173	266.0801	272.3445	283.1318	303.8072	327.4484	345.2277	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				7.0500	19.6403	0.6300	0.7000	0.7700	42.3164 (76)			
South				0.6500	46.7521	0.6300	0.7000	0.7700	9.2872 (78)			
West				4.2000	19.6403	0.6300	0.7000	0.7700	25.2097 (80)			
Solar gains	76.8133	147.3055	236.9172	339.1703	411.6482	419.9961	400.4028	346.3465	273.2501	173.1478	95.2056	63.5552 (83)
Total gains	432.2560	500.1452	576.7897	658.5674	710.3698	698.7133	666.4830	618.6911	556.3818	476.9550	422.6541	408.7829 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2206	59.3474	59.4723	60.0657	60.1781	60.7067	60.7067	60.8056	60.5020	60.1781	59.9512	59.7159	
alpha	4.9480	4.9565	4.9648	5.0044	5.0119	5.0471	5.0471	5.0537	5.0335	5.0119	4.9967	4.9811	
util living area	0.9977	0.9949	0.9854	0.9504	0.8561	0.6852	0.5184	0.5762	0.8328	0.9738	0.9953	0.9983	(86)
MIT	19.7446	19.9023	20.1751	20.5265	20.8081	20.9547	20.9909	20.9849	20.8778	20.4964	20.0537	19.7157	(87)
Th 2	19.9420	19.9440	19.9459	19.9552	19.9570	19.9651	19.9651	19.9666	19.9620	19.9570	19.9535	19.9498	(88)
util rest of house	0.9970	0.9932	0.9802	0.9323	0.8063	0.5934	0.4018	0.4559	0.7579	0.9608	0.9934	0.9977	(89)
MIT 2	18.2726	18.5039	18.9007	19.4042	19.7720	19.9356	19.9618	19.9605	19.8651	19.3727	18.7324	18.2359	(90)
Living area fraction	18.8530	19.0553	19.4032	19.8467	20.1806	20.3374	20.3676	20.3644	20.2644	19.8157	19.2534	18.8193	(91)
MIT	18.8530	19.0553	19.4032	19.8467	20.1806	20.3374	20.3676	20.3644	20.2644	19.8157	19.2534	18.8193	(92)
Temperature adjustment	18.8530	19.0553	19.4032	19.8467	20.1806	20.3374	20.3676	20.3644	20.2644	19.8157	19.2534	18.8193	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.4477	495.7096	563.3627	612.4859	581.2067	438.8331	298.6409	311.5822	435.2349	457.1918	419.1192	407.4712	(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	1194.5802	1159.4514	1054.6709	885.9170	685.0487	459.4245	301.6893	316.9362	495.2857	744.4353	985.4490	1190.0728	(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	568.5146	446.0345	365.5333	196.8704	77.2584	0.0000	0.0000	0.0000	0.0000	213.7092	407.7574	582.2556	(98)
Space heating												2857.9334	(98)
Space heating per m2												40.8276	(99)

8c. Space cooling requirement

Not applicable

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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												3059.8859 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	568.5146	446.0345	365.5333	196.8704	77.2584	0.0000	0.0000	0.0000	0.0000	213.7092	407.7574	582.2556 (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)	608.6880	477.5530	391.3633	210.7820	82.7178	0.0000	0.0000	0.0000	0.0000	228.8107	436.5711	623.4000 (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	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	87.6190	87.3974	86.8708	85.6595	83.4739	80.3000	80.3000	80.3000	80.3000	85.7467	87.1337	80.3000 (216)
(217)m	87.6190	87.3974	86.8708	85.6595	83.4739	80.3000	80.3000	80.3000	80.3000	85.7467	87.1337	87.7140 (217)
Fuel for water heating, kWh/month	218.9977	191.7852	200.7496	180.5727	179.4036	164.2541	157.3679	175.4284	177.3658	189.1372	198.6865	213.6232 (219)
Water heating fuel used	218.9977	191.7852	200.7496	180.5727	179.4036	164.2541	157.3679	175.4284	177.3658	189.1372	198.6865	2247.3718 (219)
Annual totals kWh/year												
Space heating fuel - main system												3059.8859 (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)												320.3737 (232)
Total delivered energy for all uses												5702.6314 (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	3059.8859	0.2160	660.9353 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2247.3718	0.2160	485.4323 (264)
Space and water heating			1146.3677 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	320.3737	0.5190	166.2740 (268)
Total CO2, kg/m2/year			1351.5666 (272)
Emissions per m2 for space and water heating			16.3767 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3753 (272b)
Emissions per m2 for pumps and fans			0.5561 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3767 * 1.00) + 2.3753 + 0.5561, rounded to 2 d.p.			19.3100 (273)

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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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.6700
Infiltration rate					0.3467 (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) =	0.2947 (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	0.3757	0.3683	0.3610	0.3241	0.3168	0.2799	0.2799	0.2726	0.2947	0.3168	0.3315	0.3462 (22b)
Effective ac	0.5706	0.5678	0.5651	0.5525	0.5502	0.5392	0.5392	0.5371	0.5434	0.5502	0.5549	0.5599 (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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17497.6495 (34)
249.9664 (35)
6.9863 (36)
(33) + (36) = 52.0396 (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	33.2799	33.1201	32.9634	32.2275	32.0899	31.4489	31.4489	31.3302	31.6958	32.0899	32.3684	32.6596 (38)
Heat transfer coeff	85.3195	85.1597	85.0030	84.2672	84.1295	83.4885	83.4885	83.3699	83.7354	84.1295	84.4080	84.6992 (39)
Average = Sum(39)m / 12 =												84.2665 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2189	1.2166	1.2143	1.2038	1.2018	1.1927	1.1927	1.1910	1.1962	1.2018	1.2058	1.2100 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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 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												Total = Sum(45)m = 1377.4311 (45)

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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	18.1409	16.1126	13.1036	9.9203	7.4155	6.2605	6.7647	8.7930	11.8020	14.9853	17.4901	18.6451	(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	312.9190	311.6456	300.7936	282.9782	264.2401	246.7189	235.6828	239.2963	248.7551	266.6982	287.3318	303.4309	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				7.0500	19.6403	0.4500	0.0000		0.7700		47.9777 (76)	
South				0.6500	46.7521	0.4500	0.0000		0.7700		10.5297 (78)	
West				4.2000	19.6403	0.4500	0.0000		0.7700		28.5825 (80)	
Solar gains	87.0899	167.0130	268.6136	384.5468	466.7213	476.1860	453.9715	392.6831	309.8073	196.3127	107.9429	72.0580 (83)
Total gains	400.0089	478.6586	569.4072	667.5250	730.9614	722.9050	689.6543	631.9794	558.5624	463.0109	395.2747	375.4889 (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	56.9677	57.0746	57.1798	57.6792	57.7735	58.2171	58.2171	58.2999	58.0454	57.7735	57.5829	57.3849	
alpha	4.7978	4.8050	4.8120	4.8453	4.8516	4.8811	4.8811	4.8867	4.8697	4.8516	4.8389	4.8257	
util living area	0.9984	0.9958	0.9868	0.9516	0.8560	0.6861	0.5209	0.5849	0.8433	0.9780	0.9966	0.9988	(86)
MIT	19.6411	19.8143	20.1105	20.4892	20.7917	20.9489	20.9892	20.9815	20.8580	20.4389	19.9648	19.6091	(87)
Th 2	19.9049	19.9068	19.9086	19.9169	19.9185	19.9258	19.9258	19.9272	19.9230	19.9185	19.9153	19.9120	(88)
util rest of house	0.9978	0.9944	0.9819	0.9335	0.8053	0.5917	0.3998	0.4593	0.7688	0.9667	0.9951	0.9984	(89)
MIT 2	18.6695	18.8435	19.1385	19.5114	19.7819	19.9033	19.9232	19.9222	19.8456	19.4714	19.0010	18.6432	(90)
Living area fraction									fLA = Living area / (4) =			0.3943	(91)
MIT	19.0526	19.2263	19.5217	19.8969	20.1800	20.3156	20.3435	20.3399	20.2448	19.8529	19.3810	19.0241	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0526	19.2263	19.5217	19.8969	20.1800	20.3156	20.3435	20.3399	20.2448	19.8529	19.3810	19.0241	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9932	0.9798	0.9331	0.8189	0.6277	0.4479	0.5093	0.7939	0.9658	0.9942	0.9979	(94)
Ext temp.	398.8922	475.3992	557.8787	622.8696	598.5713	453.7966	308.9173	321.8828	443.4299	447.1664	392.9636	374.7112	(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	1258.6838	1220.0225	1106.8866	926.6780	713.4212	477.1852	312.5408	328.4659	514.5375	778.4379	1036.6146	1255.5873	(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	639.6849	500.3869	408.4619	218.7420	85.4483	0.0000	0.0000	0.0000	0.0000	246.4660	463.4287	655.3718	(98)
Space heating per m2												3217.9906	(98)
										(98) / (4) =		45.9713	(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	784.7924	617.8153	633.6109	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8916	0.9413	0.9181	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	699.7091	581.5380	581.7200	0.0000	0.0000	0.0000	0.0000	(102)

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Calculation Type: New Build (As Built)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.6312	888.0986	822.1104	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	164.8239	228.0810	178.8505	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												571.7554 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	41.2060	57.0203	44.7126	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												142.9389 (107)
Space cooling per m2												2.0420 (108)
Energy for space heating												45.9713 (99)
Energy for space cooling												2.0420 (108)
Total												48.0133 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)		
	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)			11.9000	1.3258	15.7765		(27)						
ground			35.0000	0.1300	4.5500		(28a)						
external	84.8400	14.0000	70.8400	0.1800	12.7512		(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) =	39.7277		(33)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6760 (36)						
Total fabric heat loss						(33) + (36) =	48.4037 (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	82.0848	81.9094	81.7375	80.9299	80.7788	80.0754	80.0754	79.9451	80.3463	80.7788	81.0844	81.4040 (39)	
Average = Sum(39)m / 12 =												80.9291 (39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1726	1.1701	1.1677	1.1561	1.1540	1.1439	1.1439	1.1421	1.1478	1.1540	1.1583	1.1629 (40)	
HLP (average)												1.1561 (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												
0.0000	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												

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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	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	18.1409	16.1126	13.1036	9.9203	7.4155	6.2605	6.7647	8.7930	11.8020	14.9853	17.4901	18.6451	(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	312.9190	311.6456	300.7936	282.9782	264.2401	246.7189	235.6828	239.2963	248.7551	266.6982	287.3318	303.4309	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				7.0500	19.6403	0.6300	0.7000	0.7700	42.3164 (76)			
South				0.6500	46.7521	0.6300	0.7000	0.7700	9.2872 (78)			
West				4.2000	19.6403	0.6300	0.7000	0.7700	25.2097 (80)			

Solar gains	76.8133	147.3055	236.9172	339.1703	411.6482	419.9961	400.4028	346.3465	273.2501	173.1478	95.2056	63.5552 (83)
Total gains	389.7323	458.9510	537.7108	622.1485	675.8883	666.7150	636.0856	585.6428	522.0051	439.8460	382.5374	366.9861 (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, nilm (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2206	59.3474	59.4723	60.0657	60.1781	60.7067	60.7067	60.8056	60.5020	60.1781	59.9512	59.7159	
alpha	4.9480	4.9565	4.9648	5.0044	5.0119	5.0471	5.0471	5.0537	5.0335	5.0119	4.9967	4.9811	
util living area	0.9986	0.9965	0.9891	0.9597	0.8744	0.7095	0.5410	0.6043	0.8583	0.9810	0.9970	0.9990	(86)
MIT	19.6884	19.8485	20.1263	20.4878	20.7852	20.9470	20.9890	20.9814	20.8573	20.4522	20.0011	19.6602	(87)
Th 2	19.9420	19.9440	19.9459	19.9552	19.9570	19.9651	19.9651	19.9666	19.9620	19.9570	19.9535	19.9498	(88)
util rest of house	0.9981	0.9953	0.9851	0.9443	0.8281	0.6176	0.4204	0.4802	0.7886	0.9712	0.9958	0.9986	(89)
MIT 2	18.7461	18.9074	19.1845	19.5435	19.8131	19.9411	19.9624	19.9614	19.8823	19.5163	19.0676	18.7242	(90)
Living area fraction									fLA = Living area / (4) =			0.3943	(91)
MIT	19.1176	19.2785	19.5558	19.9158	20.1964	20.3377	20.3671	20.3636	20.2667	19.8853	19.4356	19.0932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1176	19.2785	19.5558	19.9158	20.1964	20.3377	20.3671	20.3636	20.2667	19.8853	19.4356	19.0932	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9943	0.9832	0.9436	0.8400	0.6526	0.4684	0.5296	0.8118	0.9703	0.9949	0.9982	(94)
Ext temp.	388.7821	456.3189	528.6833	587.0350	567.7369	435.0721	297.9420	310.1801	423.7449	426.7826	380.5923	366.3203	(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	1216.3037	1177.7310	1067.1518	891.5098	686.3293	459.4494	301.6557	316.8666	495.4751	750.0572	1000.2282	1212.3699	(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	615.6761	484.7889	400.6206	219.2219	88.2328	0.0000	0.0000	0.0000	0.0000	240.5163	446.1379	629.4609	(98)
Space heating												3124.6553	(98)
Space heating per m2										(98) / (4) =		44.6379	(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	752.7084	592.5577	607.5828	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8861	0.9388	0.9156	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	666.9410	556.3005	556.3285	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	862.9546	825.4859	767.9508	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	141.1298	200.2739	157.4470	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												498.8507	(104)

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.2825	50.0685	39.3617	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												124.7127 (107)
Space cooling per m2												1.7816 (108)
Energy for space heating												44.6379 (99)
Energy for space cooling												1.7816 (108)
Total												46.4195 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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											4.6700	
Infiltration rate											0.2335 (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) =	0.1985 (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												
	0.2332	0.2183	0.2183	0.1985	0.2034	0.1935	0.1935	0.1886	0.1886	0.2034	0.1985	0.2034 (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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533			(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) =	17497.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.9664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9863 (36)
Total fabric heat loss						(33) + (36) =	52.0396 (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	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034 (39)
Average = Sum(39)m / 12 =												81.2034 (39)
HLP	Jan 1.1600	Feb 1.1600	Mar 1.1600	Apr 1.1600	May 1.1600	Jun 1.1600	Jul 1.1600	Aug 1.1600	Sep 1.1600	Oct 1.1600	Nov 1.1600	Dec 1.1600 (40)
HLP (average)												1.1600 (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	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	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	45.3522	40.2814	32.7591	24.8007	18.5388	15.6513	16.9117	21.9825	29.5049	37.4632	43.7251	46.6127 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
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	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)
	507.0273	502.9825	483.5497	453.4767	422.8062	395.2404	379.0656	386.7753	404.0234	434.2963	467.9383	493.2775 (73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
East				7.0500	25.1733		0.4500	0.0000		0.7700	61.4939 (76)	
South				0.6500	56.5862		0.4500	0.0000		0.7700	12.7446 (78)	
West				4.2000	25.1733		0.4500	0.0000		0.7700	36.6346 (80)	
Solar gains	110.8731	180.9941	295.8019	423.5498	482.3349	543.9270	498.4509	450.8666	356.6433	229.4655	136.9948	86.8187 (83)
Total gains	617.9004	683.9766	779.3516	877.0266	905.1412	939.1674	877.5165	837.6420	760.6667	663.7618	604.9331	580.0962 (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	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554
util living area	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904
	0.9848	0.9746	0.9379	0.8369	0.6663	0.4368	0.3048	0.3096	0.5785	0.8664	0.9670	0.9880 (86)
MIT	20.1401	20.2614	20.5217	20.7975	20.9486	20.9948	20.9993	20.9993	20.9803	20.8023	20.4349	20.1036 (87)
Th 2	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521 (88)
util rest of house	0.9797	0.9664	0.9188	0.7926	0.5926	0.3491	0.2083	0.2086	0.4790	0.8159	0.9543	0.9839 (89)
MIT 2	19.2020	19.3200	19.5677	19.8116	19.9253	19.9506	19.9520	19.9520	19.9451	19.8234	19.4907	19.1665 (90)
Living area fraction	19.5719	19.6912	19.9438	20.2003	20.3288	20.3623	20.3650	20.3649	fLA = Living area / (4) =	20.2094	19.8630	0.3943 (91)
MIT	19.5719	19.6912	19.9438	20.2003	20.3288	20.3623	20.3650	20.3649	20.3532	20.2094	19.8630	19.5359 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4219	19.5412	19.7938	20.0503	20.1788	20.2123	20.2150	20.2149	20.2032	20.0594	19.7130	19.3859 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9765	0.9625	0.9154	0.7972	0.6093	0.3711	0.2326	0.2340	0.5037	0.8218	0.9507	0.9810 (94)
Ext temp.	603.3678	658.2976	713.3948	699.1345	551.5212	348.5691	204.1145	195.9948	383.1330	545.4702	575.1184	569.0590 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1122.3821	1099.5897	990.1815	808.0015	574.8198	350.1710	204.2230	196.1019	390.0391	646.3286	902.4097	1111.3447 (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	386.1466	296.5482	205.9293	78.3843	17.3342	0.0000	0.0000	0.0000	0.0000	75.0386	235.6497	403.4605 (98)
RHI space heating demand												1698.4915 (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	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																4.6700	
Infiltration rate																0.2335 (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) =						0.1985 (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																	
	0.2531	0.2481	0.2431	0.2183	0.2134	0.1886	0.1886	0.1836	0.1985	0.2134	0.2233	0.2332 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5031	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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533			(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) =	17497.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.9664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9863 (36)
Total fabric heat loss						(33) + (36) =	52.0396 (37)

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

(38)m	Jan 29.3420	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	81.3816	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034 (39)
Average = Sum(39)m / 12 =												81.2182 (39)
HLP	Jan 1.1626	Feb 1.1600	Mar 1.1600	Apr 1.1600	May 1.1600	Jun 1.1600	Jul 1.1600	Aug 1.1600	Sep 1.1600	Oct 1.1600	Nov 1.1600	Dec 1.1600 (40)
HLP (average)												1.1603 (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												
Solar input	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)
	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	45.3522	40.2814	32.7591	24.8007	18.5388	15.6513	16.9117	21.9825	29.5049	37.4632	43.7251	46.6127 (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	507.0273	502.9825	483.5497	453.4767	422.8062	395.2404	379.0656	386.7753	404.0234	434.2963	467.9383	493.2775 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East			7.0500		19.6403		0.4500		0.0000		0.7700		47.9777 (76)
South			0.6500		46.7521		0.4500		0.0000		0.7700		10.5297 (78)
West			4.2000		19.6403		0.4500		0.0000		0.7700		28.5825 (80)
Solar gains	87.0899	167.0130	268.6136	384.5468	466.7213	476.1860	453.9715	392.6831	309.8073	196.3127	107.9429		72.0580 (83)
Total gains	594.1172	669.9955	752.1633	838.0236	889.5276	871.4264	833.0370	779.4585	713.8307	630.6090	575.8812		565.3356 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.7243	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554
alpha	4.9816	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904
util living area	0.9908	0.9823	0.9586	0.8918	0.7584	0.5773	0.4253	0.4728	0.7191	0.9286	0.9826	0.9927 (86)
MIT	19.9686	20.1305	20.3887	20.6850	20.8920	20.9777	20.9960	20.9933	20.9370	20.6532	20.2462	19.9245 (87)
Th 2	19.9500	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521 (88)
util rest of house	0.9879	0.9769	0.9458	0.8603	0.6980	0.4908	0.3259	0.3684	0.6337	0.9001	0.9763	0.9904 (89)
MIT 2	19.0308	19.1916	19.4419	19.7156	19.8862	19.9429	19.9512	19.9504	19.9215	19.6952	19.3073	18.9888 (90)
Living area fraction									fLA =	Living area / (4) =		0.3943 (91)
MIT	19.4005	19.5618	19.8152	20.0978	20.2828	20.3509	20.3631	20.3616	20.3219	20.0729	19.6775	19.3578 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2505	19.4118	19.6652	19.9478	20.1328	20.2009	20.2131	20.2116	20.1719	19.9229	19.5275	19.2078 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9854	0.9733	0.9416	0.8601	0.7091	0.5120	0.3510	0.3947	0.6529	0.8992	0.9729	0.9883 (94)
Useful gains	585.4464	652.1206	708.2480	720.7952	630.7834	446.1622	292.3551	307.6474	466.0551	567.0167	560.2960	558.7098 (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	1216.6992	1178.4079	1069.0576	897.1205	684.7681	454.8116	293.3976	309.5136	493.0593	757.0535	1009.1535	1218.6817 (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	469.6521	353.6651	268.4424	126.9542	40.1646	0.0000	0.0000	0.0000	0.0000	141.3874	323.1773	491.0191 (98)
Space heating												2214.4622 (98)
Space heating per m2										(98) / (4) =		31.6352 (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												2446.9195	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.6521	353.6651	268.4424	126.9542	40.1646	0.0000	0.0000	0.0000	0.0000	141.3874	323.1773	491.0191	(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)	518.9526	390.7902	296.6214	140.2809	44.3808	0.0000	0.0000	0.0000	0.0000	156.2292	357.1020	542.5625	(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	89.6769	89.5803	89.3620	88.8778	88.0723	87.3000	87.3000	87.3000	87.3000	88.9342	89.5036	87.3000	(216)
(217)m	89.6769	89.5803	89.3620	88.8778	88.0723	87.3000	87.3000	87.3000	87.3000	88.9342	89.5036	89.7211	(217)
Fuel for water heating, kWh/month	174.9579	153.6121	159.9351	141.6689	138.2833	122.0263	114.7023	129.3075	130.1650	146.9414	157.4861	169.8376	(219)
Water heating fuel used												1738.9234	(219)
Annual totals kWh/year													
Space heating fuel - main system												2446.9195	(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)												320.3737	(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												4091.1108	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2446.9195	3.4800	85.1528 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1738.9234	3.4800	60.5145 (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	320.3737	13.1900	42.2573 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-537.4497	13.1900	-70.8896 (252)
Total energy cost			253.1722 (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] = 0.9246 (257)
SAP value	87.1014
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	2446.9195	0.2160	528.5346 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1738.9234	0.2160	375.6075 (264)
Space and water heating			904.1421 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	320.3737	0.5190	166.2740 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			854.9761 (272)
CO2 emissions per m2			12.2100 (273)
EI value			90.0377
EI rating			90 (274)
EI band			B

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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												4.6700
Infiltration rate												0.2335 (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) =	0.1985 (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												
	0.2332	0.2183	0.2183	0.1985	0.2034	0.1935	0.1935	0.1886	0.1886	0.2034	0.1985	0.2034 (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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533			(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) =	17497.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.9664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9863 (36)
Total fabric heat loss						(33) + (36) =	52.0396 (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	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034 (39)
Average = Sum(39)m / 12 =												81.2034 (39)
HLP	Jan 1.1600	Feb 1.1600	Mar 1.1600	Apr 1.1600	May 1.1600	Jun 1.1600	Jul 1.1600	Aug 1.1600	Sep 1.1600	Oct 1.1600	Nov 1.1600	Dec 1.1600 (40)
HLP (average)												1.1600 (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												
Solar input	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)
	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	45.3522	40.2814	32.7591	24.8007	18.5388	15.6513	16.9117	21.9825	29.5049	37.4632	43.7251	46.6127 (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	507.0273	502.9825	483.5497	453.4767	422.8062	395.2404	379.0656	386.7753	404.0234	434.2963	467.9383	493.2775 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East				7.0500	25.1733	0.4500	0.0000			0.7700			61.4939 (76)
South				0.6500	56.5862	0.4500	0.0000			0.7700			12.7446 (78)
West				4.2000	25.1733	0.4500	0.0000			0.7700			36.6346 (80)
Solar gains	110.8731	180.9941	295.8019	423.5498	482.3349	543.9270	498.4509	450.8666	356.6433	229.4655	136.9948	86.8187	(83)
Total gains	617.9004	683.9766	779.3516	877.0266	905.1412	939.1674	877.5165	837.6420	760.6667	663.7618	604.9331	580.0962	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554
alpha	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904
util living area	0.9848	0.9746	0.9379	0.8369	0.6663	0.4368	0.3048	0.3096	0.5785	0.8664	0.9670	0.9880 (86)
MIT	20.1401	20.2614	20.5217	20.7975	20.9486	20.9948	20.9993	20.9993	20.9803	20.8023	20.4349	20.1036 (87)
Th 2	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521 (88)
util rest of house	0.9797	0.9664	0.9188	0.7926	0.5926	0.3491	0.2083	0.2086	0.4790	0.8159	0.9543	0.9839 (89)
MIT 2	19.2020	19.3200	19.5677	19.8116	19.9253	19.9506	19.9520	19.9520	19.9451	19.8234	19.4907	19.1665 (90)
Living area fraction									fLA =	Living area / (4) =		0.3943 (91)
MIT	19.5719	19.6912	19.9438	20.2003	20.3288	20.3623	20.3650	20.3649	20.3532	20.2094	19.8630	19.5359 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4219	19.5412	19.7938	20.0503	20.1788	20.2123	20.2150	20.2149	20.2032	20.0594	19.7130	19.3859 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9765	0.9625	0.9154	0.7972	0.6093	0.3711	0.2326	0.2340	0.5037	0.8218	0.9507	0.9810 (94)
Useful gains	603.3678	658.2976	713.3948	699.1345	551.5212	348.5691	204.1145	195.9948	383.1330	545.4702	575.1184	569.0590 (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	1122.3821	1099.5897	990.1815	808.0015	574.8198	350.1710	204.2230	196.1019	390.0391	646.3286	902.4097	1111.3447 (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	386.1466	296.5482	205.9293	78.3843	17.3342	0.0000	0.0000	0.0000	0.0000	75.0386	235.6497	403.4605 (98)
Space heating												1698.4915 (98)
Space heating per m2										(98) / (4) =		24.2642 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1876.7862	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	386.1466	296.5482	205.9293	78.3843	17.3342	0.0000	0.0000	0.0000	0.0000	75.0386	235.6497	403.4605	(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)	426.6814	327.6776	227.5462	86.6125	19.1538	0.0000	0.0000	0.0000	0.0000	82.9156	260.3864	445.8128	(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	89.5516	89.4607	89.1610	88.5006	87.6863	87.3000	87.3000	87.3000	87.3000	88.4407	89.2752	87.3000	(216)
Fuel for water heating, kWh/month	175.2026	153.8175	160.2955	142.2726	138.8920	122.0263	114.7023	129.3075	130.1650	147.7613	157.8891	170.0679	(219)
Water heating fuel used												1742.3996	(219)
Annual totals kWh/year													
Space heating fuel - main system												1876.7862	(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)												320.3737	(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												3452.1082	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1876.7862	10.2300	191.9952 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1742.3996	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	320.3737	36.7200	117.6412 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-609.7952	36.7200	-223.9168 (252)
Total energy cost			411.8918 (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	1876.7862	0.2160	405.3858 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1742.3996	0.2160	376.3583 (264)
Space and water heating			781.7441 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	320.3737	0.5190	166.2740 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			695.0309 (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	1876.7862	1.2200	2289.6792 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1742.3996	1.2200	2125.7275 (264)
Space and water heating			4415.4066 (265)
Pumps and fans	122.3439	3.0700	375.5957 (267)
Energy for lighting	320.3737	3.0700	983.5473 (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			3902.4785 (272)
Primary energy kWh/m2/year			55.7497 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 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 524 TEST (01 Aug 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	£163	£181	-£18
Mains gas	£473	£376	£97
Space heating	£340	£340	£0
Water heating	£178	£100	£78
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£412	£333	£79
Total cost of uses	£412	£334	£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																4.6700	
Infiltration rate																0.2335 (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) =						0.1985 (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																	
	0.2531	0.2481	0.2431	0.2183	0.2134	0.1886	0.1886	0.1836	0.1985	0.2134	0.2233	0.2332 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5031	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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533			(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) =	17497.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.9664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9863 (36)
Total fabric heat loss						(33) + (36) =	52.0396 (37)

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

(38)m	Jan 29.3420	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	81.3816	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034 (39)
Average = Sum(39)m / 12 =												81.2182 (39)
HLP	Jan 1.1626	Feb 1.1600	Mar 1.1600	Apr 1.1600	May 1.1600	Jun 1.1600	Jul 1.1600	Aug 1.1600	Sep 1.1600	Oct 1.1600	Nov 1.1600	Dec 1.1600 (40)
HLP (average)												1.1603 (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	45.3522	40.2814	32.7591	24.8007	18.5388	15.6513	16.9117	21.9825	29.5049	37.4632	43.7251	46.6127	(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	507.0273	502.9825	483.5497	453.4767	422.8062	395.2404	379.0656	386.7753	404.0234	434.2963	467.9383	493.2775	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				7.0500	19.6403		0.4500		0.0000		0.7700		47.9777 (76)
South				0.6500	46.7521		0.4500		0.0000		0.7700		10.5297 (78)
West				4.2000	19.6403		0.4500		0.0000		0.7700		28.5825 (80)
Solar gains	87.0899	167.0130	268.6136	384.5468	466.7213	476.1860	453.9715	392.6831	309.8073	196.3127	107.9429	72.0580	(83)
Total gains	594.1172	669.9955	752.1633	838.0236	889.5276	871.4264	833.0370	779.4585	713.8307	630.6090	575.8812	565.3356	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.7243	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554
alpha	4.9816	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904
util living area	0.9908	0.9823	0.9586	0.8918	0.7584	0.5773	0.4253	0.4728	0.7191	0.9286	0.9826	0.9927 (86)
MIT	19.9686	20.1305	20.3887	20.6850	20.8920	20.9777	20.9960	20.9933	20.9370	20.6532	20.2462	19.9245 (87)
Th 2	19.9500	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521 (88)
util rest of house	0.9879	0.9769	0.9458	0.8603	0.6980	0.4908	0.3259	0.3684	0.6337	0.9001	0.9763	0.9904 (89)
MIT 2	19.0308	19.1916	19.4419	19.7156	19.8862	19.9429	19.9512	19.9504	19.9215	19.6952	19.3073	18.9888 (90)
Living area fraction									fLA = Living area / (4) =			0.3943 (91)
MIT	19.4005	19.5618	19.8152	20.0978	20.2828	20.3509	20.3631	20.3616	20.3219	20.0729	19.6775	19.3578 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2505	19.4118	19.6652	19.9478	20.1328	20.2009	20.2131	20.2116	20.1719	19.9229	19.5275	19.2078 (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	0.9854	0.9733	0.9416	0.8601	0.7091	0.5120	0.3510	0.3947	0.6529	0.8992	0.9729	0.9883	(94)
Useful gains	585.4464	652.1206	708.2480	720.7952	630.7834	446.1622	292.3551	307.6474	466.0551	567.0167	560.2960	558.7098	(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	1216.6992	1178.4079	1069.0576	897.1205	684.7681	454.8116	293.3976	309.5136	493.0593	757.0535	1009.1535	1218.6817	(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	469.6521	353.6651	268.4424	126.9542	40.1646	0.0000	0.0000	0.0000	0.0000	141.3874	323.1773	491.0191	(98)
Space heating												2214.4622	(98)
Space heating per m2											(98) / (4) =	31.6352	(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													2446.9195	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	469.6521	353.6651	268.4424	126.9542	40.1646	0.0000	0.0000	0.0000	0.0000	141.3874	323.1773	491.0191	(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)	518.9526	390.7902	296.6214	140.2809	44.3808	0.0000	0.0000	0.0000	0.0000	156.2292	357.1020	542.5625	(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	(217)m	89.7736	89.7869	89.7802	89.7873	89.8652	87.3000	87.3000	87.3000	87.3000	89.3187	89.6505	87.3000	(216)
Fuel for water heating, kWh/month	148.2086	108.9427	83.7095	39.0830	10.6694	0.0000	0.0000	20.3658	44.8418	89.3600	125.6799	147.4667	(219)	
Water heating fuel used												818.3273	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2446.9195	(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)													320.3737	(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													3220.5147	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2446.9195	3.4800	85.1528	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	818.3273	3.4800	28.4778	(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	320.3737	13.1900	42.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			227.7304	(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] =	0.8317	(257)
SAP value		88.3976	
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	2446.9195	0.2160	528.5346 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	818.3273	0.2160	176.7587 (264)
Space and water heating			705.2933 (265)
Pumps and fans	172.3439	0.5190	89.4465 (267)
Energy for lighting	320.3737	0.5190	166.2740 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			682.0773 (272)
CO2 emissions per m2			9.7400 (273)
EI value			92.0523
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												4.6700
Infiltration rate												0.2335 (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) =	0.1985 (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												
	0.2332	0.2183	0.2183	0.1985	0.2034	0.1935	0.1935	0.1886	0.1886	0.2034	0.1985	0.2034 (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)			11.9000	1.3258	15.7765		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	14.0000	70.8400	0.2700	19.1268	150.0000	10625.9995 (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) =	45.0533			(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) =	17497.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							249.9664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9863 (36)
Total fabric heat loss						(33) + (36) =	52.0396 (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	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034	81.2034 (39)
Average = Sum(39)m / 12 =												81.2034 (39)
HLP	Jan 1.1600	Feb 1.1600	Mar 1.1600	Apr 1.1600	May 1.1600	Jun 1.1600	Jul 1.1600	Aug 1.1600	Sep 1.1600	Oct 1.1600	Nov 1.1600	Dec 1.1600 (40)
HLP (average)												1.1600 (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	45.3522	40.2814	32.7591	24.8007	18.5388	15.6513	16.9117	21.9825	29.5049	37.4632	43.7251	46.6127	(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	507.0273	502.9825	483.5497	453.4767	422.8062	395.2404	379.0656	386.7753	404.0234	434.2963	467.9383	493.2775	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W

East				7.0500	25.1733		0.4500		0.0000		0.7700		61.4939 (76)
South				0.6500	56.5862		0.4500		0.0000		0.7700		12.7446 (78)
West				4.2000	25.1733		0.4500		0.0000		0.7700		36.6346 (80)

Solar gains	110.8731	180.9941	295.8019	423.5498	482.3349	543.9270	498.4509	450.8666	356.6433	229.4655	136.9948		86.8187 (83)
Total gains	617.9004	683.9766	779.3516	877.0266	905.1412	939.1674	877.5165	837.6420	760.6667	663.7618	604.9331		580.0962 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	59.8554	
alpha	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	4.9904	
util living area	0.9848	0.9746	0.9379	0.8369	0.6663	0.4368	0.3048	0.3096	0.5785	0.8664	0.9670	0.9880	(86)
MIT	20.1401	20.2614	20.5217	20.7975	20.9486	20.9948	20.9993	20.9993	20.9803	20.8023	20.4349	20.1036	(87)
Th 2	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	19.9521	(88)
util rest of house	0.9797	0.9664	0.9188	0.7926	0.5926	0.3491	0.2083	0.2086	0.4790	0.8159	0.9543	0.9839	(89)
MIT 2	19.2020	19.3200	19.5677	19.8116	19.9253	19.9506	19.9520	19.9520	19.9451	19.8234	19.4907	19.1665	(90)
Living area fraction									fLA = Living area / (4) =			0.3943	(91)
MIT	19.5719	19.6912	19.9438	20.2003	20.3288	20.3623	20.3650	20.3649	20.3532	20.2094	19.8630	19.5359	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4219	19.5412	19.7938	20.0503	20.1788	20.2123	20.2150	20.2149	20.2032	20.0594	19.7130	19.3859	(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	0.9765	0.9625	0.9154	0.7972	0.6093	0.3711	0.2326	0.2340	0.5037	0.8218	0.9507	0.9810	(94)
Useful gains	603.3678	658.2976	713.3948	699.1345	551.5212	348.5691	204.1145	195.9948	383.1330	545.4702	575.1184	569.0590	(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	1122.3821	1099.5897	990.1815	808.0015	574.8198	350.1710	204.2230	196.1019	390.0391	646.3286	902.4097	1111.3447	(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	386.1466	296.5482	205.9293	78.3843	17.3342	0.0000	0.0000	0.0000	0.0000	75.0386	235.6497	403.4605	(98)
Space heating												1698.4915	(98)
Space heating per m2											(98) / (4) =	24.2642	(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													1876.7862 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	386.1466	296.5482	205.9293	78.3843	17.3342	0.0000	0.0000	0.0000	0.0000	75.0386	235.6497	403.4605	(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)	426.6814	327.6776	227.5462	86.6125	19.1538	0.0000	0.0000	0.0000	0.0000	82.9156	260.3864	445.8128	(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	89.6764	89.6829	89.6286	89.5143	89.0090	87.3000	87.3000	87.3000	87.3000	88.8595	89.4688	87.3000	(216)
(217)m	89.6764	89.6829	89.6286	89.5143	89.0090	87.3000	87.3000	87.3000	87.3000	88.8595	89.4688	89.6970	(217)
Fuel for water heating, kWh/month	143.9691	109.3685	82.9442	37.6043	16.3887	0.0000	0.0000	13.8219	39.7746	85.6867	120.8086	145.3507	(219)
Water heating fuel used												795.7172	(219)
Annual totals kWh/year													
Space heating fuel - main system												1876.7862	(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)													320.3737 (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												2555.4259	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1876.7862	10.2300	191.9952 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	795.7172	10.2300	81.4019 (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	320.3737	36.7200	117.6412 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-609.7952	36.7200	-223.9168 (252)
Total energy cost			333.4062 (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	1876.7862	0.2160	405.3858 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	795.7172	0.2160	171.8749 (264)
Space and water heating			577.2607 (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	320.3737	0.5190	166.2740 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			516.4975 (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	1876.7862	1.2200	2289.6792 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	795.7172	1.2200	970.7750 (264)
Space and water heating			3260.4542 (265)
Pumps and fans	172.3439	3.0700	529.0957 (267)
Energy for lighting	320.3737	3.0700	983.5473 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			2901.0260 (272)
Primary energy kWh/m2/year			41.4432 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace 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	250.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	233.31 (P1)
Transmission heat loss coefficient	52.04 (37)
Summer heat loss coefficient	285.35 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	7.0500	125.2818	0.4500	0.0000	0.9000	357.7108
South	0.6500	118.5567	0.4500	0.0000	0.9000	31.2100
West	4.2000	125.2818	0.4500	0.0000	0.9000	213.1043
total:						602.0252

	Jun	Jul	Aug	
Solar gains	647	602	533	(P4)
Internal gains	392	376	384	
Total summer gains	1039	978	917	(P5)
Summer gain/loss ratio	3.64	3.43	3.21	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	19.29	20.98	20.76	(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 88	Issued on Date	10/08/2023
Assessment Reference	88 Hamble	Prop Type Ref	21809
Property	6 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	87 B	DER	14.29
Environmental	90 B	TER	19.31
CO ₂ Emissions (t/year)	0.70	% DER<TER	25.99
General Requirements Compliance	Pass	DFEE	48.01
		TFEE	53.38
		% DFEE<TFEE	10.06
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)	19.31	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.29	kgCO ₂ /m ²	Pass
	-5.02 (-26.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.38	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.01	kWh/m ² /yr	
	-5.4 (-10.1%)	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	4.67 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

7.05 m², No overhang

Windows facing South

0.65 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

4.67 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

0.74

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 88	Issued on Date	10/08/2023
Assessment Reference	88 Hamble	Prop Type Ref	21809
Property	6 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	87 B	DER	14.29
Environmental	90 B	% DER<TER	25.99
CO ₂ Emissions (t/year)	0.70	DFEE	48.01
General Requirements Compliance	Pass	% DFEE<TFEE	10.06
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
Client	Y128-0001		

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Owner-occupied
Transaction Type	Marketed sale
Terrain Type	Suburban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor: 1.00 m	35.00 m ²	2.45 m
	1st Storey: 1.00 m	35.00 m ²	2.60 m

7.0 Living Area	27.60	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	249.97	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.27	150.00	84.84	70.84

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
party	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	41.41

9.2 Internal Walls				
Description	Construction	Kappa (kJ/m ² K)	Area (m ²)	
stud	Plasterboard on timber frame	9.00	124.80	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cd	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	35.00	35.00

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
internal	Other	9.00	35.00

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	35.00

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	35.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
entrance	Manufacturer	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft 0.05			0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
entrance	Solid Door	[1] external	West							2.10	
front	Window	[1] external	West	None	0.00					4.20	
rear	Window	[1] external	East	None	0.00					7.05	
side	Window	[1] external	South	None	0.00					0.65	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.70	0.300	No
Independently assessed	E3 Sill	6.30	0.015	No
Independently assessed	E4 Jamb	20.20	0.011	No
Independently assessed	E5 Ground floor (normal)	16.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	16.80	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.60	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.20	0.063	No
Independently assessed	E16 Corner (normal)	10.20	0.067	No
Independently assessed	E18 Party wall between dwellings	10.20	0.042	No
Independently assessed	P1 Party wall - Ground floor	8.20	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.20	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.20	0.091	No

Y-value	0.045	W/m ² K
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18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows half open

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

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

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	20	
Total number of L.E.L. fittings	20	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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

32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.74	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£78	B 88	