

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 87			Issued on Date	21/08/2023
Assessment Reference	87 Hamble	Prop Type Ref	21809		
Property	5 Hickory Way, Hedge End, Southampton, SO30 0AW				
SAP Rating	88 B	DER	12.14	TER	17.90
Environmental	92 A	% DER<TER	32.17		
CO ₂ Emissions (t/year)	0.59	DFEE	38.75	TFEE	45.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.65		
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk			Assessor ID	AU40-0001
Client					

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

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DWELLING AS BUILT

Mid-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) 17.90 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.14 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.8 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	0.11 (max. 0.25)	0.11 (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: 4.44 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 7.05 m², No overhang
Windows facing West: 4.20 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4400
Infiltration rate												0.2220 (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) =	0.1887 (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												
	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.8364		(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) =	13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss						(33) + (36) =	39.9542 (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	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179 (39)
Average = Sum(39)m / 12 =												69.1179 (39)
HLP	Jan 0.9874	Feb 0.9874	Mar 0.9874	Apr 0.9874	May 0.9874	Jun 0.9874	Jul 0.9874	Aug 0.9874	Sep 0.9874	Oct 0.9874	Nov 0.9874	Dec 0.9874 (40)
HLP (average)												0.9874 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3344	16.2844	13.2434	10.0261	7.4946	6.3273	6.8368	8.8868	11.9278	15.1451	17.6766	18.8439 (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	343.8798	341.8475	329.4371	309.5148	289.4035	269.9760	257.3379	263.0352	273.2609	293.3830	316.4658	333.6667 (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)
West				4.2000	19.6403	0.4500	0.0000			0.7700			28.5825 (80)

Solar gains	76.5602	149.7680	246.6466	359.7193	440.8495	451.2879	429.6445	369.0583	286.8601	177.7123	95.4616	62.9594	(83)
Total gains	420.4400	491.6155	576.0836	669.2341	730.2530	721.2639	686.9824	632.0935	560.1210	471.0954	411.9274	396.6261	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387
alpha	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492
util living area	0.9935	0.9863	0.9641	0.8979	0.7639	0.5858	0.4366	0.4918	0.7484	0.9442	0.9878	0.9950 (86)
MIT	19.7303	19.9175	20.2297	20.5941	20.8536	20.9658	20.9927	20.9878	20.9005	20.5277	20.0452	19.6786 (87)
Th 2	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938 (88)
util rest of house	0.9919	0.9829	0.9552	0.8738	0.7150	0.5126	0.3496	0.4000	0.6795	0.9257	0.9842	0.9938 (89)
MIT 2	18.9309	19.1165	19.4228	19.7681	19.9938	20.0766	20.0915	20.0896	20.0358	19.7144	19.2445	18.8795 (90)
Living area fraction	19.2461	19.4323	19.7409	20.0938	20.3328	20.4272	20.4469	20.4437	20.3767	20.0351	19.5602	19.1946 (92)
MIT	19.2461	19.4323	19.7409	20.0938	20.3328	20.4272	20.4469	20.4437	20.3767	20.0351	19.5602	19.1946 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0961	19.2823	19.5909	19.9438	20.1828	20.2772	20.2969	20.2937	20.2267	19.8851	19.4102	19.0446 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	416.0677	481.3118	546.8582	581.7147	525.8667	380.7820	253.7279	265.9206	386.7407	433.6686	403.9473	393.3861 (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	1022.6755	994.0753	904.8189	763.3246	586.3116	392.3979	255.5194	269.1260	423.4667	641.7652	850.8552	1026.0269 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	451.3162	344.5771	266.3227	130.7591	44.9710	0.0000	0.0000	0.0000	0.0000	154.8239	321.7737	470.6848 (98)
Space heating												2185.2285 (98)
Space heating per m2												31.2175 (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													2414.6171	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	451.3162	344.5771	266.3227	130.7591	44.9710	0.0000	0.0000	0.0000	0.0000	154.8239	321.7737	470.6848	(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)	498.6920	380.7482	294.2792	144.4852	49.6917	0.0000	0.0000	0.0000	0.0000	171.0761	355.5511	520.0937	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	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	89.6523	89.5631	89.3561	88.9014	88.1405	87.3000	87.3000	87.3000	87.3000	89.0067	89.5006	87.3000	(216)	
Fuel for water heating, kWh/month	175.0059	153.6415	159.9455	141.6312	138.1764	122.0263	114.7023	129.3075	130.1650	146.8217	157.4914	169.8853	(219)	
Water heating fuel used												1738.8000	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2414.6171	(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)													323.7905	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =													-537.4497	(233)
Total delivered energy for all uses													4062.1017	(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	2414.6171	0.2160	521.5573	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1738.8000	0.2160	375.5808	(264)
Space and water heating			897.1381	(265)
Pumps and fans	122.3439	0.5190	63.4965	(267)
Energy for lighting	323.7905	0.5190	168.0473	(268)
Energy saving/generation technologies				
PV Unit	-537.4497	0.5190	-278.9364	(269)
Total CO2, kg/year			849.7454	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1400	(273)

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

DER			12.1400	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			31.3121	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			31.3121	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000	/ (5) =	0.1132 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3632 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3087 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)			11.2500	1.3258	14.9148		(27)					
ground			35.0000	0.1300	4.5500		(28a)					
external	43.4300	13.3500	30.0800	0.1800	5.4144		(29a)					
cd	35.0000		35.0000	0.1300	4.5500		(30)					
Total net area of external elements Aum(A, m2)			113.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5292		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0410 (36)					
Total fabric heat loss						(33) + (36) =	39.5702 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.6811	Feb 33.5057	Mar 33.3337	Apr 32.5261	May 32.3750	Jun 31.6717	Jul 31.6717	Aug 31.5414	Sep 31.9426	Oct 32.3750	Nov 32.6807	Dec 33.0003 (38)
Heat transfer coeff	73.2513	73.0759	72.9039	72.0963	71.9452	71.2418	71.2418	71.1116	71.5128	71.9452	72.2509	72.5705 (39)
Average = Sum(39)m / 12 =												72.0956 (39)
HLP	Jan 1.0464	Feb 1.0439	Mar 1.0415	Apr 1.0299	May 1.0278	Jun 1.0177	Jul 1.0177	Aug 1.0159	Sep 1.0216	Oct 1.0278	Nov 1.0322	Dec 1.0367 (40)
HLP (average)												1.0299 (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	18.3344	16.2844	13.2434	10.0261	7.4946	6.3273	6.8368	8.8868	11.9278	15.1451	17.6766	18.8439	(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	355.6361	353.0116	340.0122	319.5028	298.8007	278.7840	266.1522	272.4383	283.2576	303.9670	327.6350	345.4266	(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
West					4.2000	19.6403	0.6300	0.7000			0.7700	25.2097 (80)

Solar gains	67.5261	132.0954	217.5423	317.2724	388.8293	398.0359	378.9464	325.5094	253.0107	156.7423	84.1971	55.5302 (83)
Total gains	423.1622	485.1069	557.5545	636.7753	687.6300	676.8200	645.0987	597.9477	536.2683	460.7093	411.8321	400.9567 (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	66.3621	66.5214	66.6783	67.4252	67.5668	68.2340	68.2340	68.3589	67.9754	67.5668	67.2810	66.9847	
alpha	5.4241	5.4348	5.4452	5.4950	5.5045	5.5489	5.5489	5.5573	5.5317	5.5045	5.4854	5.4656	
util living area	0.9979	0.9952	0.9853	0.9450	0.8345	0.6471	0.4813	0.5382	0.8096	0.9722	0.9955	0.9985	(86)
MIT	19.9047	20.0509	20.3050	20.6288	20.8692	20.9753	20.9959	20.9927	20.9185	20.5879	20.1852	19.8782	(87)
Th 2	20.0448	20.0469	20.0489	20.0585	20.0602	20.0686	20.0686	20.0701	20.0654	20.0602	20.0566	20.0528	(88)
util rest of house	0.9972	0.9936	0.9802	0.9261	0.7845	0.5639	0.3819	0.4340	0.7363	0.9591	0.9938	0.9979	(89)
MIT 2	18.5801	18.7948	19.1643	19.6270	19.9355	20.0526	20.0671	20.0672	20.0015	19.5804	18.9986	18.5474	(90)
Living area fraction	19.1023	19.2901	19.6141	20.0220	20.3037	20.4164	20.4333	20.4321	20.3631	19.9776	19.4665	19.0721	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1023	19.2901	19.6141	20.0220	20.3037	20.4164	20.4333	20.4321	20.3631	19.9776	19.4665	19.0721	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	421.5912	481.1797	544.8307	589.1889	549.0819	403.3713	271.7514	284.1959	408.4759	441.1792	408.6396	399.8303	(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	1084.2903	1051.5670	956.0660	801.8561	618.9942	414.3718	273.0920	286.7284	447.8909	674.6740	893.4874	1079.2764	(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	493.0481	383.3003	305.9590	153.1204	52.0148	0.0000	0.0000	0.0000	0.0000	173.7201	349.0904	505.5079	(98)
Space heating												2415.7610	(98)
Space heating per m2												34.5109	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2586.4679 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	493.0481	383.3003	305.9590	153.1204	52.0148	0.0000	0.0000	0.0000	0.0000	173.7201	349.0904	505.5079	(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)	527.8888	410.3858	327.5793	163.9405	55.6903	0.0000	0.0000	0.0000	0.0000	185.9958	373.7584	541.2290	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774	(64)
Efficiency of water heater (217)m	87.3230	87.0681	86.4522	85.0257	82.6814	80.3000	80.3000	80.3000	80.3000	85.2245	86.7814	87.4263	(217)
Fuel for water heating, kWh/month	219.7400	192.5105	201.7216	181.9186	181.1233	164.2541	157.3679	175.4284	177.3658	190.2962	199.4930	214.3263	(219)
Water heating fuel used												2255.5457	(219)
Annual totals kWh/year													
Space heating fuel - main system												2586.4679	(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)												323.7905	(232)
Total delivered energy for all uses												5240.8040	(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	2586.4679	0.2160	558.6771 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2255.5457	0.2160	487.1979 (264)
Space and water heating			1045.8749 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	323.7905	0.5190	168.0473 (268)
Total CO2, kg/m2/year			1252.8472 (272)
Emissions per m2 for space and water heating			14.9411 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4007 (272b)
Emissions per m2 for pumps and fans			0.5561 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9411 * 1.00) + 2.4007 + 0.5561, rounded to 2 d.p.			17.9000 (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	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1132 (8)
Pressure test					Yes
Measured/design AP50					4.4400
Infiltration rate					0.3352 (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) =	0.2849 (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	0.3632	0.3561	0.3490	0.3134	0.3062	0.2706	0.2706	0.2635	0.2849	0.3062	0.3205	0.3347 (22b)
Effective ac	0.5660	0.5634	0.5609	0.5491	0.5469	0.5366	0.5366	0.5347	0.5406	0.5469	0.5514	0.5560 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.8364		(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) = 13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss							(33) + (36) = 39.9542 (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	33.0114	32.8620	32.7155	32.0276	31.8989	31.2998	31.2998	31.1889	31.5306	31.8989	32.1593	32.4315 (38)
Heat transfer coeff	72.9655	72.8161	72.6697	71.9818	71.8531	71.2540	71.2540	71.1431	71.4848	71.8531	72.1135	72.3857 (39)
Average = Sum(39)m / 12 =												71.9812 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0424	1.0402	1.0381	1.0283	1.0265	1.0179	1.0179	1.0163	1.0212	1.0265	1.0302	1.0341 (40)
HLP (average)												1.0283 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)

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

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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	18.3344	16.2844	13.2434	10.0261	7.4946	6.3273	6.8368	8.8868	11.9278	15.1451	17.6766	18.8439	(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	313.1125	311.8174	300.9333	283.0840	264.3192	246.7857	235.7549	239.3901	248.8809	266.8580	287.5183	303.6297	(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)		
West					4.2000	19.6403	0.4500	0.0000	0.7700	28.5825 (80)		
Solar gains	76.5602	149.7680	246.6466	359.7193	440.8495	451.2879	429.6445	369.0583	286.8601	177.7123	95.4616	62.9594 (83)
Total gains	389.6727	461.5854	547.5799	642.8033	705.1687	698.0736	665.3994	608.4483	535.7411	444.5704	382.9799	366.5891 (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	50.4313	50.5348	50.6367	51.1206	51.2121	51.6427	51.6427	51.7232	51.4760	51.2121	51.0272	50.8353	
alpha	4.3621	4.3690	4.3758	4.4080	4.4141	4.4428	4.4428	4.4482	4.4317	4.4141	4.4018	4.3890	
util living area	0.9953	0.9896	0.9718	0.9149	0.7927	0.6154	0.4622	0.5215	0.7807	0.9565	0.9910	0.9964	(86)
MIT	19.5862	19.7815	20.1114	20.5169	20.8134	20.9547	20.9898	20.9830	20.8717	20.4498	19.9369	19.5491	(87)
Th 2	20.0482	20.0499	20.0517	20.0598	20.0613	20.0684	20.0684	20.0697	20.0657	20.0613	20.0582	20.0550	(88)
util rest of house	0.9941	0.9870	0.9644	0.8932	0.7448	0.5389	0.3685	0.4233	0.7128	0.9410	0.9883	0.9954	(89)
MIT 2	18.7517	18.9472	19.2736	19.6685	19.9322	20.0454	20.0652	20.0638	19.9895	19.6146	19.1093	18.7202	(90)
Living area fraction									fLA = Living area / (4) =				(91)
MIT	19.0807	19.2761	19.6039	20.0030	20.2796	20.4039	20.4297	20.4262	20.3373	19.9439	19.4356	19.0470	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0807	19.2761	19.6039	20.0030	20.2796	20.4039	20.4297	20.4262	20.3373	19.9439	19.4356	19.0470	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9842	0.9602	0.8917	0.7567	0.5674	0.4055	0.4619	0.7342	0.9387	0.9859	0.9941	(94)
Useful gains	386.7262	454.2842	525.8010	573.2039	533.6172	396.0754	269.7912	281.0360	393.3537	417.3017	377.5825	364.4306	(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	1078.4842	1046.8153	952.2593	799.2173	616.4728	413.5521	272.8837	286.4369	445.8748	671.3915	889.5643	1074.7125	(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	514.6679	398.1810	317.2850	162.7296	61.6445	0.0000	0.0000	0.0000	0.0000	189.0429	368.6269	528.4497	(98)
Space heating												2540.6275	(98)
Space heating per m2												36.2947	(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	669.7876	527.2796	540.6872	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9138	0.9526	0.9343	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	612.0748	502.3125	505.1742	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	899.6964	859.8448	794.7314	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	207.0876	266.0040	215.4306	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												688.5221 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.7719	66.5010	53.8576	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												172.1305 (107)
Space cooling per m2												2.4590 (108)
Energy for space heating												36.2947 (99)
Energy for space cooling												2.4590 (108)
Total												38.7537 (109)
Dwelling Fabric Energy Efficiency (DFEE)												38.8 (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)			11.2500	1.3258	14.9148		(27)					
ground			35.0000	0.1300	4.5500		(28a)					
external	43.4300	13.3500	30.0800	0.1800	5.4144		(29a)					
cd	35.0000		35.0000	0.1300	4.5500		(30)					
Total net area of external elements Aum(A, m2)			113.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5292		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0410 (36)					
Total fabric heat loss						(33) + (36) =	39.5702 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.6811	Feb 33.5057	Mar 33.3337	Apr 32.5261	May 32.3750	Jun 31.6717	Jul 31.6717	Aug 31.5414	Sep 31.9426	Oct 32.3750	Nov 32.6807	Dec 33.0003 (38)
Heat transfer coeff	73.2513	73.0759	72.9039	72.0963	71.9452	71.2418	71.2418	71.1116	71.5128	71.9452	72.2509	72.5705 (39)
Average = Sum(39)m / 12 =												72.0956 (39)
HLP	Jan 1.0464	Feb 1.0439	Mar 1.0415	Apr 1.0299	May 1.0278	Jun 1.0177	Jul 1.0177	Aug 1.0159	Sep 1.0216	Oct 1.0278	Nov 1.0322	Dec 1.0367 (40)
HLP (average)												1.0299 (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 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	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	18.3344	16.2844	13.2434	10.0261	7.4946	6.3273	6.8368	8.8868	11.9278	15.1451	17.6766	18.8439	(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	313.1125	311.8174	300.9333	283.0840	264.3192	246.7857	235.7549	239.3901	248.8809	266.8580	287.5183	303.6297	(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)
West				4.2000				19.6403	0.6300	0.7000	0.7700			25.2097 (80)

Solar gains	67.5261	132.0954	217.5423	317.2724	388.8293	398.0359	378.9464	325.5094	253.0107	156.7423	84.1971	55.5302	(83)	
Total gains	380.6386	443.9128	518.4756	600.3564	653.1485	644.8217	614.7014	564.8995	501.8916	423.6003	371.7154	359.1599	(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	66.3621	66.5214	66.6783	67.4252	67.5668	68.2340	68.2340	68.3589	67.9754	67.5668	67.2810	66.9847	
alpha	5.4241	5.4348	5.4452	5.4950	5.5045	5.5489	5.5489	5.5573	5.5317	5.5045	5.4854	5.4656	
util living area	0.9988	0.9969	0.9894	0.9561	0.8563	0.6733	0.5039	0.5670	0.8396	0.9806	0.9973	0.9991	(86)
MIT	19.8471	19.9958	20.2552	20.5908	20.8493	20.9701	20.9949	20.9906	20.9010	20.5433	20.1313	19.8214	(87)
Th 2	20.0448	20.0469	20.0489	20.0585	20.0602	20.0686	20.0686	20.0701	20.0654	20.0602	20.0566	20.0528	(88)
util rest of house	0.9984	0.9958	0.9856	0.9403	0.8094	0.5890	0.4005	0.4586	0.7707	0.9709	0.9962	0.9988	(89)
MIT 2	18.9873	19.1373	19.3963	19.7293	19.9603	20.0551	20.0673	20.0675	20.0107	19.6906	19.2808	18.9683	(90)
Living area fraction	19.3263	19.4758	19.7350	20.0689	20.3108	20.4159	20.4330	20.4315	fLA = Living area / (4) =			0.3943	(91)
MIT	19.3263	19.4758	19.7350	20.0689	20.3108	20.4159	20.4330	20.4315	20.3617	20.0268	19.6162	19.3046	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3263	19.4758	19.7350	20.0689	20.3108	20.4159	20.4330	20.4315	20.3617	20.0268	19.6162	19.3046	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9950	0.9840	0.9405	0.8230	0.6217	0.4415	0.5017	0.7948	0.9705	0.9955	0.9985	(94)
Ext temp.	379.8528	441.6798	510.1740	564.6199	537.5584	400.8652	271.3818	283.3879	398.8952	411.0941	370.0416	358.6171	(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	1100.6971	1065.1418	964.8821	805.2400	619.5065	414.3342	273.0720	286.6834	447.7933	678.2146	904.3036	1096.1505	(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	536.3082	418.9665	338.3028	173.2464	60.9694	0.0000	0.0000	0.0000	0.0000	198.7376	384.6686	548.7249	(98)
Space heating per m2												2659.9244	(98)
												37.9989	(99)
												(98) / (4) =	

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	669.6732	527.1895	540.4479	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9246	0.9641	0.9472	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	619.1980	508.2376	511.8880	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	837.4539	800.5874	743.8301	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	157.1442	217.5082	172.5649	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												547.2174	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	39.2861	54.3770	43.1412	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											136.8043 (107)
Space cooling per m2											1.9543 (108)
Energy for space heating											37.9989 (99)
Energy for space cooling											1.9543 (108)
Total											39.9533 (109)
Target Fabric Energy Efficiency (TFEE)											45.9 (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												4.4400
Infiltration rate												0.2220 (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) =	0.1887 (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												
	0.2217	0.2076	0.2076	0.1887	0.1934	0.1840	0.1840	0.1793	0.1793	0.1934	0.1887	0.1934 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.8364		(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) =	13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss						(33) + (36) =	39.9542 (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	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179 (39)
Average = Sum(39)m / 12 =												69.1179 (39)
HLP	Jan 0.9874	Feb 0.9874	Mar 0.9874	Apr 0.9874	May 0.9874	Jun 0.9874	Jul 0.9874	Aug 0.9874	Sep 0.9874	Oct 0.9874	Nov 0.9874	Dec 0.9874 (40)
HLP (average)												0.9874 (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												1542.3261 (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												
(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	45.8359	40.7110	33.1084	25.0652	18.7365	15.8182	17.0921	22.2170	29.8196	37.8628	44.1914	47.1098 (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)
	507.5110	503.4121	483.8991	453.7412	423.0040	395.4073	379.2459	387.0098	404.3380	434.6958	468.4046	493.7746 (73)

6. Solar gains

[Jan]				Area	Solar flux			g	FF			Access			Gains
				m2	Table 6a			Specific data	Specific data			factor			W
					W/m2			or Table 6b	or Table 6c			Table 6d			
East				7.0500	25.1733			0.4500	0.0000			0.7700			61.4939 (76)
West				4.2000	25.1733			0.4500	0.0000			0.7700			36.6346 (80)
Solar gains	98.1285	163.2931	272.9085	397.4794	456.5572	516.3370	472.6104	424.8920	331.5965	208.8944	121.9542				76.3820 (83)
Total gains	605.6395	666.7052	756.8076	851.2206	879.5612	911.7443	851.8563	811.9018	735.9346	643.5903	590.3588				570.1566 (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	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387
util living area	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492
MIT	0.9653	0.9476	0.8917	0.7665	0.5918	0.3835	0.2673	0.2719	0.5121	0.8008	0.9347	0.9713 (86)
Th 2	20.1729	20.3018	20.5668	20.8259	20.9561	20.9950	20.9993	20.9993	20.9825	20.8280	20.4737	20.1317 (87)
util rest of house	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938 (88)
MIT 2	0.9573	0.9360	0.8694	0.7253	0.5327	0.3167	0.1941	0.1952	0.4348	0.7522	0.9176	0.9645 (89)
Living area fraction	19.3664	19.4903	19.7394	19.9674	20.0683	20.0920	20.0937	20.0937	20.0862	19.9760	19.6582	19.3267 (90)
MIT	19.6844	19.8102	20.0656	20.3059	20.4183	20.4480	20.4508	20.4508	20.4396	20.3119	19.9797	19.6441 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5344	19.6602	19.9156	20.1559	20.2683	20.2980	20.3008	20.3008	20.2896	20.1619	19.8297	19.4941 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9513	0.9294	0.8644	0.7283	0.5445	0.3319	0.2109	0.2127	0.4519	0.7562	0.9117	0.9589 (94)
Ext temp.	576.1478	619.6431	654.1997	619.9452	478.8788	302.6110	179.6399	172.7276	332.5878	486.7026	538.2446	546.7036 (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	963.1154	944.1676	851.2295	695.0428	495.4597	303.9838	179.7596	172.8471	337.9603	557.2229	776.1758	953.4210 (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	287.9040	218.0805	146.5902	54.0702	12.3362	0.0000	0.0000	0.0000	0.0000	52.4671	171.3105	302.5977 (98)
RHI space heating demand												1245.3562 (98)
												1245 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4400
Infiltration rate												0.2220 (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) =	0.1887 (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												
	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	32.8364			(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) =	13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss						(33) + (36) =	39.9542 (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	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179 (39)
Average = Sum(39)m / 12 =												69.1179 (39)
HLP	Jan 0.9874	Feb 0.9874	Mar 0.9874	Apr 0.9874	May 0.9874	Jun 0.9874	Jul 0.9874	Aug 0.9874	Sep 0.9874	Oct 0.9874	Nov 0.9874	Dec 0.9874 (40)
HLP (average)												0.9874 (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	45.8359	40.7110	33.1084	25.0652	18.7365	15.8182	17.0921	22.2170	29.8196	37.8628	44.1914	47.1098 (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	507.5110	503.4121	483.8991	453.7412	423.0040	395.4073	379.2459	387.0098	404.3380	434.6958	468.4046	493.7746 (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)
West					4.2000	19.6403	0.4500	0.0000			0.7700	28.5825 (80)

Solar gains	76.5602	149.7680	246.6466	359.7193	440.8495	451.2879	429.6445	369.0583	286.8601	177.7123	95.4616	62.9594 (83)
Total gains	584.0712	653.1801	730.5456	813.4605	863.8535	846.6952	808.8904	756.0680	691.1982	612.4082	563.8662	556.7340 (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	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387
util living area	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492
	0.9772	0.9614	0.9222	0.8310	0.6825	0.5091	0.3732	0.4157	0.6447	0.8787	0.9614	0.9813 (86)
MIT	19.9941	20.1642	20.4337	20.7235	20.9083	20.9805	20.9962	20.9938	20.9460	20.6885	20.2783	19.9401 (87)
Th 2	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938 (88)
util rest of house												
	0.9721	0.9530	0.9059	0.7987	0.6311	0.4420	0.2977	0.3361	0.5745	0.8469	0.9516	0.9771 (89)
MIT 2	19.1908	19.3566	19.6150	19.8801	20.0335	20.0843	20.0927	20.0918	20.0642	19.8567	19.4706	19.1378 (90)
Living area fraction									fLA =	Living area / (4) =		0.3943 (91)
MIT	19.5075	19.6750	19.9378	20.2126	20.3784	20.4377	20.4489	20.4474	20.4119	20.1847	19.7890	19.4541 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3575	19.5250	19.7878	20.0626	20.2284	20.2877	20.2989	20.2974	20.2619	20.0347	19.6390	19.3041 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9670	0.9468	0.8996	0.7975	0.6391	0.4566	0.3149	0.3542	0.5881	0.8445	0.9455	0.9724 (94)
Ext temp.	564.7785	618.3987	657.1846	648.6962	552.0759	386.6063	254.7314	267.7904	406.5174	517.2083	533.1633	541.3862 (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)
	1040.7430	1010.8517	918.4249	771.5379	589.4682	393.1199	255.6598	269.3808	425.8981	652.1063	866.6730	1043.9654 (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	354.1176	263.7284	194.3628	88.4460	27.8199	0.0000	0.0000	0.0000	0.0000	100.3641	240.1270	373.9189 (98)
Space heating												1642.8846 (98)
Space heating per m2										(98) / (4) =		23.4698 (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													1815.3421 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	354.1176	263.7284	194.3628	88.4460	27.8199	0.0000	0.0000	0.0000	0.0000	100.3641	240.1270	373.9189	(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)	391.2901	291.4126	214.7655	97.7304	30.7402	0.0000	0.0000	0.0000	0.0000	110.8996	265.3337	413.1701	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	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	89.4928	89.3767	89.1158	88.5925	87.8778	87.3000	87.3000	87.3000	87.3000	88.6618	89.2894	89.5496	(216)
Fuel for water heating, kWh/month	175.3177	153.9619	160.3768	142.1251	138.5893	122.0263	114.7023	129.3075	130.1650	147.3928	157.8640	170.1629	(219)
Water heating fuel used												1741.9916	(219)
Annual totals kWh/year													
Space heating fuel - main system												1815.3421	(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)													323.7905 (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													3466.0183 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1815.3421	3.4800	63.1739 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1741.9916	3.4800	60.6213 (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	323.7905	13.1900	42.7080 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-537.4497	13.1900	-70.8896 (252)
Total energy cost			231.7507 (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] =	0.8464 (257)
SAP value		88.1928
SAP rating (Section 12)		88 (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	1815.3421	0.2160	392.1139 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1741.9916	0.2160	376.2702 (264)
Space and water heating			768.3841 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	323.7905	0.5190	168.0473 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			720.9914 (272)
CO2 emissions per m2			10.3000 (273)
EI value			91.5989
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8843 = 3.935$, stars = 4
Water heating environmental impact	$0.216 / 0.8843 = 0.2443$, 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												4.4400
Infiltration rate												0.2220 (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) =	0.1887 (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												
	0.2217	0.2076	0.2076	0.1887	0.1934	0.1840	0.1840	0.1793	0.1793	0.1934	0.1887	0.1934 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	32.8364			(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) =	13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss						(33) + (36) =	39.9542 (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	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179 (39)
Average = Sum(39)m / 12 =												69.1179 (39)
HLP	Jan 0.9874	Feb 0.9874	Mar 0.9874	Apr 0.9874	May 0.9874	Jun 0.9874	Jul 0.9874	Aug 0.9874	Sep 0.9874	Oct 0.9874	Nov 0.9874	Dec 0.9874 (40)
HLP (average)												0.9874 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum (45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month												
	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
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	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												
	45.8359	40.7110	33.1084	25.0652	18.7365	15.8182	17.0921	22.2170	29.8196	37.8628	44.1914	47.1098 (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												
	507.5110	503.4121	483.8991	453.7412	423.0040	395.4073	379.2459	387.0098	404.3380	434.6958	468.4046	493.7746 (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)
West				4.2000	25.1733	0.4500	0.0000				0.7700	36.6346 (80)

Solar gains	98.1285	163.2931	272.9085	397.4794	456.5572	516.3370	472.6104	424.8920	331.5965	208.8944	121.9542	76.3820 (83)
Total gains	605.6395	666.7052	756.8076	851.2206	879.5612	911.7443	851.8563	811.9018	735.9346	643.5903	590.3588	570.1566 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387
alpha	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492
util living area												
	0.9653	0.9476	0.8917	0.7665	0.5918	0.3835	0.2673	0.2719	0.5121	0.8008	0.9347	0.9713 (86)
MIT	20.1729	20.3018	20.5668	20.8259	20.9561	20.9950	20.9993	20.9993	20.9825	20.8280	20.4737	20.1317 (87)
Th 2	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938 (88)
util rest of house												
	0.9573	0.9360	0.8694	0.7253	0.5327	0.3167	0.1941	0.1952	0.4348	0.7522	0.9176	0.9645 (89)
MIT 2	19.3664	19.4903	19.7394	19.9674	20.0683	20.0920	20.0937	20.0937	20.0862	19.9760	19.6582	19.3267 (90)
Living area fraction												
	19.6844	19.8102	20.0656	20.3059	20.4183	20.4480	20.4508	20.4508	fLA = Living area / (4) =	20.3119	19.7979	0.3943 (91)
MIT									20.4396	20.3119	19.7979	19.6441 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5344	19.6602	19.9156	20.1559	20.2683	20.2980	20.3008	20.3008	20.2896	20.1619	19.8297	19.4941 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9513	0.9294	0.8644	0.7283	0.5445	0.3319	0.2109	0.2127	0.4519	0.7562	0.9117	0.9589 (94)
Useful gains	576.1478	619.6431	654.1997	619.9452	478.8788	302.6110	179.6399	172.7276	332.5878	486.7026	538.2446	546.7036 (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												
	963.1154	944.1676	851.2295	695.0428	495.4597	303.9838	179.7596	172.8471	337.9603	557.2229	776.1758	953.4210 (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												
	287.9040	218.0805	146.5902	54.0702	12.3362	0.0000	0.0000	0.0000	0.0000	52.4671	171.3105	302.5977 (98)
Space heating												1245.3562 (98)
Space heating per m ²										(98) / (4) =		17.7908 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1376.0842 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	287.9040	218.0805	146.5902	54.0702	12.3362	0.0000	0.0000	0.0000	0.0000	52.4671	171.3105	302.5977	(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)	318.1259	240.9729	161.9781	59.7461	13.6311	0.0000	0.0000	0.0000	0.0000	57.9747	189.2933	334.3621	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	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	89.3448	89.2346	88.8915	88.2373	87.5848	87.3000	87.3000	87.3000	87.3000	88.1933	89.0270	89.4025	(216)
Fuel for water heating, kWh/month	175.6081	154.2072	160.7816	142.6972	139.0529	122.0263	114.7023	129.3075	130.1650	148.1757	158.3293	170.4430	(219)
Water heating fuel used												1745.4961	(219)
Annual totals kWh/year													
Space heating fuel - main system												1376.0842	(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)													323.7905 (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													2957.9195 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1376.0842	10.2300	140.7734 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1745.4961	10.2300	178.5643 (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	323.7905	36.7200	118.8959 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-609.7952	36.7200	-223.9168 (252)
Total energy cost			362.2414 (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	1376.0842	0.2160	297.2342 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1745.4961	0.2160	377.0272 (264)
Space and water heating			674.2614 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	323.7905	0.5190	168.0473 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			589.3214 (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	1376.0842	1.2200	1678.8227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1745.4961	1.2200	2129.5053 (264)
Space and water heating			3808.3280 (265)
Pumps and fans	122.3439	3.0700	375.5957 (267)
Energy for lighting	323.7905	3.0700	994.0367 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

3305.8893 (272)
47.2270 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 92

(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	-£ 79	-179 kg (30.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79 2.55 kg/m ²	B 89	A 94
Total Savings	£79 2.55 kg/m ²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 94

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	£164	£182	-£18
Mains gas	£422	£325	£97
Space heating	£289	£289	£0
Water heating	£179	£100	£79
Lighting	£119	£119	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£362	£283	£79
Total cost of uses	£363	£284	£79
Delivered energy	42 kWh/m ²	29 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m ²	8 kg/m ²	6 kg/m ²	3 kg/m ²
Primary energy	47 kWh/m ²	33 kWh/m ²	14 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												4.4400
Infiltration rate												0.2220 (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) =	0.1887 (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												
	0.2406	0.2359	0.2312	0.2076	0.2029	0.1793	0.1793	0.1745	0.1887	0.2029	0.2123	0.2217 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	32.8364			(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) =	13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss						(33) + (36) =	39.9542 (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	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179 (39)
Average = Sum(39)m / 12 =												69.1179 (39)
HLP	Jan 0.9874	Feb 0.9874	Mar 0.9874	Apr 0.9874	May 0.9874	Jun 0.9874	Jul 0.9874	Aug 0.9874	Sep 0.9874	Oct 0.9874	Nov 0.9874	Dec 0.9874 (40)
HLP (average)												0.9874 (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	45.8359	40.7110	33.1084	25.0652	18.7365	15.8182	17.0921	22.2170	29.8196	37.8628	44.1914	47.1098	(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	507.5110	503.4121	483.8991	453.7412	423.0040	395.4073	379.2459	387.0098	404.3380	434.6958	468.4046	493.7746	(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)	
West					4.2000	19.6403	0.4500		0.0000	0.7700		28.5825 (80)	

Solar gains	76.5602	149.7680	246.6466	359.7193	440.8495	451.2879	429.6445	369.0583	286.8601	177.7123	95.4616	62.9594 (83)	
Total gains	584.0712	653.1801	730.5456	813.4605	863.8535	846.6952	808.8904	756.0680	691.1982	612.4082	563.8662	556.7340 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387
alpha	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492
util living area												
	0.9772	0.9614	0.9222	0.8310	0.6825	0.5091	0.3732	0.4157	0.6447	0.8787	0.9614	0.9813 (86)
MIT	19.9941	20.1642	20.4337	20.7235	20.9083	20.9805	20.9962	20.9938	20.9460	20.6885	20.2783	19.9401 (87)
Th 2	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938 (88)
util rest of house												
	0.9721	0.9530	0.9059	0.7987	0.6311	0.4420	0.2977	0.3361	0.5745	0.8469	0.9516	0.9771 (89)
MIT 2	19.1908	19.3566	19.6150	19.8801	20.0335	20.0843	20.0927	20.0918	20.0642	19.8567	19.4706	19.1378 (90)
Living area fraction									fLA = Living area / (4) =			0.3943 (91)
MIT	19.5075	19.6750	19.9378	20.2126	20.3784	20.4377	20.4489	20.4474	20.4119	20.1847	19.7890	19.4541 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3575	19.5250	19.7878	20.0626	20.2284	20.2877	20.2989	20.2974	20.2619	20.0347	19.6390	19.3041 (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	0.9670	0.9468	0.8996	0.7975	0.6391	0.4566	0.3149	0.3542	0.5881	0.8445	0.9455	0.9724	(94)
Useful gains	564.7785	618.3987	657.1846	648.6962	552.0759	386.6063	254.7314	267.7904	406.5174	517.2083	533.1633	541.3862	(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													
	1040.7430	1010.8517	918.4249	771.5379	589.4682	393.1199	255.6598	269.3808	425.8981	652.1063	866.6730	1043.9654	(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													
	354.1176	263.7284	194.3628	88.4460	27.8199	0.0000	0.0000	0.0000	0.0000	100.3641	240.1270	373.9189	(98)
Space heating													1642.8846 (98)
Space heating per m2													(98) / (4) = 23.4698 (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													1815.3421 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	354.1176	263.7284	194.3628	88.4460	27.8199	0.0000	0.0000	0.0000	0.0000	100.3641	240.1270	373.9189	(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)	391.2901	291.4126	214.7655	97.7304	30.7402	0.0000	0.0000	0.0000	0.0000	110.8996	265.3337	413.1701	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263	(64)
Efficiency of water heater	89.6030	89.6113	89.5843	89.5674	89.6577	87.3000	87.3000	87.3000	87.3000	89.0540	89.4528	89.6407	(217)
Fuel for water heating, kWh/month	148.4907	109.1562	83.8925	39.1789	10.6941	0.0000	0.0000	20.3658	44.8418	89.6255	125.9576	147.7302	(219)
Water heating fuel used												819.9334	(219)
Annual totals kWh/year													
Space heating fuel - main system												1815.3421	(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)													323.7905 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =													-537.4497 (233)
Total delivered energy for all uses													2593.9601 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1815.3421	3.4800	63.1739	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	819.9334	3.4800	28.5337	(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	323.7905	13.1900	42.7080	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			206.2581	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.7533 (257)
SAP value			89.4916
SAP rating (Section 12)			89 (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	1815.3421	0.2160	392.1139	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	819.9334	0.2160	177.1056	(264)
Space and water heating			569.2195	(265)
Pumps and fans	172.3439	0.5190	89.4465	(267)
Energy for lighting	323.7905	0.5190	168.0473	(268)
Energy saving/generation technologies				
PV Unit	-537.4497	0.5190	-278.9364	(269)
Total kg/year			547.7768	(272)
CO2 emissions per m2			7.8300	(273)
EI value			93.6172	
EI rating			94	(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												4.4400
Infiltration rate												0.2220 (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) =	0.1887 (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												
	0.2217	0.2076	0.2076	0.1887	0.1934	0.1840	0.1840	0.1793	0.1793	0.1934	0.1887	0.1934 (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)			11.2500	1.3258	14.9148		(27)
ground			35.0000	0.1100	3.8500	75.0000	2625.0000 (28a)
external	43.4300	13.3500	30.0800	0.2700	8.1216	150.0000	4512.0001 (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)			113.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.8364		(33)
party			82.8200	0.0000	0.0000	45.0000	3726.9000 (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) =	13247.1001 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.2443 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1178 (36)
Total fabric heat loss						(33) + (36) =	39.9542 (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	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179	69.1179 (39)
Average = Sum(39)m / 12 =												69.1179 (39)
HLP	Jan 0.9874	Feb 0.9874	Mar 0.9874	Apr 0.9874	May 0.9874	Jun 0.9874	Jul 0.9874	Aug 0.9874	Sep 0.9874	Oct 0.9874	Nov 0.9874	Dec 0.9874 (40)
HLP (average)												0.9874 (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	1377.4311 (45)
Water storage loss:												
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0866	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	45.8359	40.7110	33.1084	25.0652	18.7365	15.8182	17.0921	22.2170	29.8196	37.8628	44.1914	47.1098	(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	507.5110	503.4121	483.8991	453.7412	423.0040	395.4073	379.2459	387.0098	404.3380	434.6958	468.4046	493.7746	(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)	
West					4.2000	25.1733		0.4500	0.0000	0.7700		36.6346 (80)	

Solar gains	98.1285	163.2931	272.9085	397.4794	456.5572	516.3370	472.6104	424.8920	331.5965	208.8944	121.9542	76.3820 (83)	
Total gains	605.6395	666.7052	756.8076	851.2206	879.5612	911.7443	851.8563	811.9018	735.9346	643.5903	590.3588	570.1566 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387	53.2387
alpha	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492	4.5492
util living area												
	0.9653	0.9476	0.8917	0.7665	0.5918	0.3835	0.2673	0.2719	0.5121	0.8008	0.9347	0.9713 (86)
MIT	20.1729	20.3018	20.5668	20.8259	20.9561	20.9950	20.9993	20.9993	20.9825	20.8280	20.4737	20.1317 (87)
Th 2	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938	20.0938 (88)
util rest of house												
	0.9573	0.9360	0.8694	0.7253	0.5327	0.3167	0.1941	0.1952	0.4348	0.7522	0.9176	0.9645 (89)
MIT 2	19.3664	19.4903	19.7394	19.9674	20.0683	20.0920	20.0937	20.0937	20.0862	19.9760	19.6582	19.3267 (90)
Living area fraction									fLA = Living area / (4) =			0.3943 (91)
MIT	19.6844	19.8102	20.0656	20.3059	20.4183	20.4480	20.4508	20.4508	20.4396	20.3119	19.9797	19.6441 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5344	19.6602	19.9156	20.1559	20.2683	20.2980	20.3008	20.3008	20.2896	20.1619	19.8297	19.4941 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9513	0.9294	0.8644	0.7283	0.5445	0.3319	0.2109	0.2127	0.4519	0.7562	0.9117	0.9589	(94)
Useful gains	576.1478	619.6431	654.1997	619.9452	478.8788	302.6110	179.6399	172.7276	332.5878	486.7026	538.2446	546.7036	(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													
	963.1154	944.1676	851.2295	695.0428	495.4597	303.9838	179.7596	172.8471	337.9603	557.2229	776.1758	953.4210	(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													
	287.9040	218.0805	146.5902	54.0702	12.3362	0.0000	0.0000	0.0000	0.0000	52.4671	171.3105	302.5977	(98)
Space heating													1245.3562 (98)
Space heating per m2											(98) / (4) =	17.7908	(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													1376.0842 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	287.9040	218.0805	146.5902	54.0702	12.3362	0.0000	0.0000	0.0000	0.0000	52.4671	171.3105	302.5977	(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)	318.1259	240.9729	161.9781	59.7461	13.6311	0.0000	0.0000	0.0000	0.0000	57.9747	189.2933	334.3621	(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	89.4845	89.4824	89.3974	89.2449	88.7377	87.3000	87.3000	87.3000	87.3000	88.5777	89.2346	89.5120	(216)
(217)m	144.2778	109.6136	83.1587	37.7178	16.4388	0.0000	0.0000	13.8219	39.7746	85.9593	121.1256	145.6511	(219)
Fuel for water heating, kWh/month												797.5392	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												1376.0842	(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)													323.7905 (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												2059.9625	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1376.0842	10.2300	140.7734	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	797.5392	10.2300	81.5883	(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	323.7905	36.7200	118.8959	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			283.6254	(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	1376.0842	0.2160	297.2342	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	797.5392	0.2160	172.2685	(264)
Space and water heating			469.5026	(265)
Pumps and fans	172.3439	0.5190	89.4465	(267)
Energy for lighting	323.7905	0.5190	168.0473	(268)

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Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			410.5127 (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	1376.0842	1.2200	1678.8227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	797.5392	1.2200	972.9978 (264)
Space and water heating			2651.8205 (265)
Pumps and fans	172.3439	3.0700	529.0957 (267)
Energy for lighting	323.7905	3.0700	994.0367 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			2302.8818 (272)
Primary energy kWh/m2/year			32.8983 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace 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	189.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	233.31 (P1)
Transmission heat loss coefficient	39.95 (37)
Summer heat loss coefficient	273.26 (P2)

Overhangs

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

Solar shading

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

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

total: 570.8151

Solar gains	Jun 614	Jul 571	Aug 502	(P4)
Internal gains	392	376	384	
Total summer gains	1006	947	886	(P5)

Summer gain/loss ratio	3.68	3.47	3.24	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 189.2)	0.68	0.68	0.68	
Threshold temperature	19.76	21.44	21.22	(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 87	Issued on Date	21/08/2023
Assessment Reference	87 Hamble	Prop Type Ref	21809
Property	5 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	88 B	DER	12.14
Environmental	92 A	TER	17.90
CO ₂ Emissions (t/year)	0.59	% DER<TER	32.17
General Requirements Compliance	Pass	DFEE	38.75
		TFEE	45.95
		% DFEE<TFEE	15.65
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
			AU40-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.90	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.14	kgCO ₂ /m ²	Pass
	-5.76 (-32.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.95	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	38.75	kWh/m ² /yr	
	-7.1 (-15.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (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	4.44 (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 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

4.44 (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

0.11

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 87	Issued on Date	21/08/2023
Assessment Reference	87 Hamble	Prop Type Ref	21809
Property	5 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	88 B	DER	12.14
Environmental	92 A	TER	17.90
CO ₂ Emissions (t/year)	0.59	% DER<TER	32.17
General Requirements Compliance	Pass	DfEE	38.75
		TFEE	45.95
		% DfEE<TFEE	15.65
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
			AU40-0001
Client			

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, Mid-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						
		Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
			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	189.24			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	43.43
						30.08
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	82.82
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/m²K)	Area (m²)
internal	Other	9.00	35.00

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.11	75.00	35.00

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
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/m²K)
entrance	Manufacturer	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft 0.05			0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
entrance	Solid Door	[1] external	West							2.10	
front	Window	[1] external	West	None	0.00					4.20	
rear	Window	[1] external	East	None	0.00					7.05	

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)	9.10	0.300	No
Independently assessed	E3 Sill	5.70	0.015	No
Independently assessed	E4 Jamb	18.10	0.011	No
Independently assessed	E5 Ground floor (normal)	8.60	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	8.60	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.60	0.060	No
Independently assessed	E18 Party wall between dwellings	20.40	0.042	No
Independently assessed	P1 Party wall - Ground floor	16.40	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.40	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	16.40	0.091	No

Y-value 0.063 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.01 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 4.44 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open

Cross ventilation possible Yes

Night Ventilation No

Air change rate 0.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

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	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None

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

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.74	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£79	B 89	