

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 89			Issued on Date	29/09/2023
Assessment Reference	89 Hamblewood	Prop Type Ref	21809		
Property	7 Hickory Way, Hedge End, Southampton, SO30 0AW				
SAP Rating	89 B	DER	13.13	TER	18.12
Environmental	90 B	% DER<TER	27.55		
CO ₂ Emissions (t/year)	0.85	DFEE	52.31	TFEE	57.25
General Requirements Compliance	Pass	% DFEE<TFEE	8.62		
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

Detached House, total floor area 101 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (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: 4.75 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 13.15 m², No overhang
Windows facing South: 8.35 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.036 W/m²K
Photovoltaic array 1.85 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	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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												4.7500
Infiltration rate												0.2375 (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) =	0.2019 (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												
	0.2574	0.2523	0.2473	0.2221	0.2170	0.1918	0.1918	0.1867	0.2019	0.2170	0.2271	0.2372 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5074	0.5023	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	75.0196			(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss							(33) + (36) = 83.8277 (37)

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

(38)m	Jan 42.6166	Feb 42.1927	Mar 41.9958	Apr 41.9958	May 41.9958	Jun 41.9958	Jul 41.9958	Aug 41.9958	Sep 41.9958	Oct 41.9958	Nov 41.9958	Dec 41.9958 (38)
Heat transfer coeff	126.4442	126.0203	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235 (39)
Average = Sum(39)m / 12 =												125.8916 (39)
HLP	Jan 1.2544	Feb 1.2502	Mar 1.2482	Apr 1.2482	May 1.2482	Jun 1.2482	Jul 1.2482	Aug 1.2482	Sep 1.2482	Oct 1.2482	Nov 1.2482	Dec 1.2482 (40)
HLP (average)												1.2489 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)

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Energy conte	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Energy content (annual)										Total =	Sum(45)m =	1564.5268 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	23.5635 (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	14.1459	12.7658	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (64)
Heat gains from water heating, kWh/month	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (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	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0066	20.4342	16.6182	12.5811	9.4045	7.9397	8.5791	11.1514	14.9674	19.0046	22.1812	23.6460 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.6146	260.2879	253.5514	239.2103	221.1072	204.0928	192.7262	190.0529	196.7894	211.1305	229.2336	246.2480 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340 (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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724 (71)
Water heating gains (Table 5)	77.2454	74.9443	70.1658	63.6668	59.4454	53.5039	48.4572	54.9270	57.2285	63.9547	71.5471	74.9539 (72)
Total internal gains	425.0688	422.8685	407.5376	382.6603	357.1592	332.7385	316.9646	323.3335	336.1874	361.2920	390.1641	412.0500 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				13.1500	10.6334		0.4500	0.0000	0.7700		48.4508 (74)	
South				8.3500	46.7521		0.4500	0.0000	0.7700		135.2666 (78)	
Solar gains	183.7174	314.1237	439.5285	571.6609	672.7939	684.2966	652.7701	573.4432	483.9523	349.1614	220.1073	157.2737 (83)
Total gains	608.7861	736.9923	847.0661	954.3212	1029.9531	1017.0351	969.7347	896.7767	820.1397	710.4534	610.2714	569.3238 (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	62.3463	62.5560	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539
util living area	5.1564	5.1704	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769
	0.9988	0.9966	0.9898	0.9648	0.8865	0.7273	0.5570	0.6200	0.8610	0.9802	0.9972	0.9992 (86)
MIT	19.7479	19.9213	20.1780	20.4984	20.7857	20.9453	20.9888	20.9810	20.8649	20.4897	20.0493	19.7121 (87)
Th 2	19.8767	19.8800	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816 (88)
util rest of house	0.9984	0.9953	0.9856	0.9493	0.8379	0.6265	0.4228	0.4823	0.7840	0.9687	0.9959	0.9989 (89)
MIT 2	18.7426	18.9181	19.1740	19.4850	19.7428	19.8587	19.8792	19.8770	19.8112	19.4817	19.0476	18.7108 (90)
Living area fraction	18.9122	19.0873	19.3433	19.6559	19.9187	20.0420	20.0663	20.0632	19.9889	19.6517	19.2165	18.8797 (92)
MIT	18.9122	19.0873	19.3433	19.6559	19.9187	20.0420	20.0663	20.0632	19.9889	19.6517	19.2165	18.8797 (92)
Temperature adjustment	18.7622	18.9373	19.1933	19.5059	19.7687	19.8920	19.9163	19.9132	19.8389	19.5017	19.0665	-0.1500
adjusted MIT	18.7622	18.9373	19.1933	19.5059	19.7687	19.8920	19.9163	19.9132	19.8389	19.5017	19.0665	18.7297 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9977	0.9937	0.9820	0.9425	0.8320	0.6275	0.4272	0.4864	0.7805	0.9631	0.9944	0.9984 (94)
Ext temp.	607.3863	732.3228	831.8406	899.4907	856.9372	638.1744	414.2354	436.2090	640.0838	684.2664	606.8749	568.3890 (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	1828.6577	1768.9851	1597.1172	1334.4679	1015.2348	665.8567	417.2727	442.0379	722.0888	1120.0465	1505.6699	1828.1747 (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	908.6260	696.6371	569.3658	313.1836	117.7734	0.0000	0.0000	0.0000	0.0000	324.2204	647.1324	937.2805 (98)
Space heating per m ²												4514.2192 (98)
										(98) / (4) =		44.7839 (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

4988.0876 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	908.6260	696.6371	569.3658	313.1836	117.7734	0.0000	0.0000	0.0000	0.0000	324.2204	647.1324	937.2805	(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)	1004.0066	769.7647	629.1335	346.0592	130.1364	0.0000	0.0000	0.0000	0.0000	358.2546	715.0635	1035.6691	(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	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233	(64)
Efficiency of water heater (217)m	89.9640	89.9014	89.7763	89.4806	88.7536	87.3000	87.3000	87.3000	87.3000	89.4788	89.8526	89.9905	(216)
Fuel for water heating, kWh/month	196.0271	172.0039	178.7811	157.8468	153.7923	136.5609	128.1706	144.7655	145.8103	163.8343	176.1979	190.2683	(219)
Water heating fuel used												1944.0589	(219)
Annual totals kWh/year													
Space heating fuel - main system												4988.0876	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)

mechanical ventilation fans (SFP = 0.2164)

67.2054 (230a)

central heating pump

30.0000 (230c)

main heating flue fan

45.0000 (230e)

Total electricity for the above, kWh/year

142.2054 (231)

Electricity for lighting (calculated in Appendix L)

406.3029 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 1.85 * 597 * 1.00) =

-884.0952

-884.0952 (233)

Total delivered energy for all uses

6596.5597 (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	4988.0876	0.2160	1077.4269	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1944.0589	0.2160	419.9167	(264)
Space and water heating			1497.3436	(265)
Pumps and fans	142.2054	0.5190	73.8046	(267)
Energy for lighting	406.3029	0.5190	210.8712	(268)
Energy saving/generation technologies				
PV Unit	-884.0952	0.5190	-458.8454	(269)
Total CO2, kg/year			1323.1741	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1300	(273)

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

DER		13.1300	ZC1
Total Floor Area	TFA	100.8000	
Assumed number of occupants	N	2.7468	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1445	ZC2
CO2 emissions from cooking, equation (L16)		1.8346	ZC3
Total CO2 emissions		30.1091	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.1091	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1572 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.4072 (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) =	0.3461 (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	0.4413	0.4326	0.4240	0.3807	0.3720	0.3288	0.3288	0.3201	0.3461	0.3720	0.3893	0.4066 (22b)
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			21.5000	1.3258	28.5038		(27)					
ground			50.4000	0.1300	6.5520		(28a)					
external	145.4400	23.5000	121.9400	0.1800	21.9492		(29a)					
cold	50.4000		50.4000	0.1300	6.5520		(30)					
Total net area of external elements Aum(A, m2)			246.2400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	65.5570		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9695 (36)					
Total fabric heat loss						(33) + (36) =	76.5265 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.1727	Feb 49.8552	Mar 49.5440	Apr 48.0821	May 47.8086	Jun 46.5354	Jul 46.5354	Aug 46.2996	Sep 47.0258	Oct 47.8086	Nov 48.3619	Dec 48.9404 (38)
Heat transfer coeff	126.6992	126.3817	126.0705	124.6086	124.3351	123.0619	123.0619	122.8261	123.5523	124.3351	124.8884	125.4669 (39)
Average = Sum(39)m / 12 =												124.6073 (39)
HLP	Jan 1.2569	Feb 1.2538	Mar 1.2507	Apr 1.2362	May 1.2335	Jun 1.2209	Jul 1.2209	Aug 1.2185	Sep 1.2257	Oct 1.2335	Nov 1.2390	Dec 1.2447 (40)
HLP (average)												1.2362 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3804	105.4029	101.4255	97.4480	93.4705	89.4930	89.4930	93.4705	97.4480	101.4255	105.4029	109.3804 (44)
Energy conte	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Energy content (annual)												Total = Sum(45)m = 1564.5268 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	23.5635 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.0565	47.6316	44.1336	45.6047	47.6316	48.0565	50.9589	49.3151	50.9589 (61)
Solar input	213.1669	187.8955	197.3541	175.6874	170.0964	149.8114	143.5308	160.0032	161.7702	183.4812	193.9736	208.0487 (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	213.1669	187.8955	197.3541	175.6874	170.0964	149.8114	143.5308	160.0032	161.7702	183.4812	193.9736	208.0487 (64)
	66.6739	58.6780	61.4161	54.4514	52.6275	46.1713	43.9616	49.2714	49.8239	56.8034	60.4277	64.9721 (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	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0066	20.4342	16.6182	12.5811	9.4045	7.9397	8.5791	11.1514	14.9674	19.0046	22.1812	23.6460	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.6146	260.2879	253.5514	239.2103	221.1072	204.0928	192.7262	190.0529	196.7894	211.1305	229.2336	246.2480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	(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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	(71)
Water heating gains (Table 5)	89.6154	87.3184	82.5486	75.6269	70.7358	64.1268	59.0882	66.2251	69.1999	76.3487	83.9274	87.3280	(72)
Total internal gains	437.4387	435.2427	419.9203	394.6204	368.4496	343.3614	327.5955	334.6316	348.1589	373.6859	402.5443	424.4242	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				13.1500	10.6334	0.6300		0.7000	0.7700		42.7336	
South				8.3500	46.7521	0.6300		0.7000	0.7700		119.3051 (74)	
Solar gains	162.0387	277.0571	387.6642	504.2050	593.4042	603.5496	575.7433	505.7769	426.8460	307.9604	194.1347	138.7154 (83)
Total gains	599.4775	712.2998	807.5845	898.8254	961.8539	946.9110	903.3388	840.4085	775.0048	681.6463	596.6789	563.1396 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2490	55.3878	55.5245	56.1759	56.2995	56.8819	56.8819	56.9911	56.6562	56.2995	56.0500	55.7916	
alpha	4.6833	4.6925	4.7016	4.7451	4.7533	4.7921	4.7921	4.7994	4.7771	4.7533	4.7367	4.7194	
util living area	0.9980	0.9953	0.9879	0.9634	0.8927	0.7435	0.5776	0.6359	0.8638	0.9769	0.9958	0.9986	(86)
MIT	19.6131	19.7876	20.0574	20.4113	20.7268	20.9231	20.9819	20.9718	20.8318	20.4244	19.9532	19.5845	(87)
Th 2	19.8747	19.8772	19.8797	19.8912	19.8933	19.9034	19.9034	19.9052	19.8995	19.8933	19.8889	19.8844	(88)
util rest of house	0.9974	0.9936	0.9834	0.9489	0.8490	0.6485	0.4446	0.5020	0.7930	0.9649	0.9941	0.9981	(89)
MIT 2	18.0337	18.2900	18.6835	19.1969	19.6217	19.8514	19.8967	19.8936	19.7622	19.2243	18.5407	17.9985	(90)
Living area fraction	18.3000	18.5426	18.9153	19.4017	19.8081	20.0322	20.0797	20.0754	19.9426	19.4267	18.7789	18.2660	(91)
MIT	18.3000	18.5426	18.9153	19.4017	19.8081	20.0322	20.0797	20.0754	19.9426	19.4267	18.7789	18.2660	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3000	18.5426	18.9153	19.4017	19.8081	20.0322	20.0797	20.0754	19.9426	19.4267	18.7789	18.2660	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	597.0049	705.6546	789.7605	845.2864	812.7729	625.7481	421.8424	440.5553	617.1244	652.9431	591.5367	561.3893	(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	1773.7947	1724.1743	1565.1973	1308.6043	1008.1178	668.4930	428.2235	451.4365	721.8642	1097.4644	1458.5562	1764.8143	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	875.5316	684.4452	576.9250	333.5889	145.3366	0.0000	0.0000	0.0000	0.0000	330.7238	624.2541	895.3481	(98)
Space heating												4466.1534	(98)
Space heating per m2												44.3071	(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													4781.7488 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	875.5316	684.4452	576.9250	333.5889	145.3366	0.0000	0.0000	0.0000	0.0000	330.7238	624.2541	895.3481	(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)	937.4000	732.8107	617.6927	357.1615	155.6067	0.0000	0.0000	0.0000	0.0000	354.0941	668.3663	958.6169	(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	213.1669	187.8955	197.3541	175.6874	170.0964	149.8114	143.5308	160.0032	161.7702	183.4812	193.9736	208.0487	(64)
Efficiency of water heater	88.2272	88.0155	87.5919	86.6406	84.6580	80.3000	80.3000	80.3000	80.3000	86.5170	87.7825	88.3058	(216)
Fuel for water heating, kWh/month	241.6113	213.4800	225.3110	202.7772	200.9218	186.5647	178.7432	199.2567	201.4573	212.0753	220.9706	235.6003	(219)
Water heating fuel used												2518.7692	(219)
Annual totals kWh/year													
Space heating fuel - main system												4781.7488	(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)												406.3029	(232)
Total delivered energy for all uses												7781.8210	(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	4781.7488	0.2160	1032.8578 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2518.7692	0.2160	544.0542 (264)
Space and water heating			1576.9119 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	406.3029	0.5190	210.8712 (268)
Total CO2, kg/m2/year			1826.7081 (272)
Emissions per m2 for space and water heating			15.6440 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0920 (272b)
Emissions per m2 for pumps and fans			0.3862 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6440 * 1.00) + 2.0920 + 0.3862, rounded to 2 d.p.			18.1200 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1572 (8)	
Pressure test										Yes							
Measured/design AP50										4.7500							
Infiltration rate										0.3947 (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) =					0.3355 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3355	0.3606	0.3774	0.3942 (22b)					
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.0196		(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss						(33) + (36) =	83.8277 (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	49.6784	49.3801	49.0876	47.7142	47.4572	46.2609	46.2609	46.0394	46.7217	47.4572	47.9770	48.5205 (38)
Heat transfer coeff	133.5061	133.2077	132.9153	131.5419	131.2849	130.0886	130.0886	129.8671	130.5494	131.2849	131.8047	132.3482 (39)
Average = Sum(39)m / 12 =												131.5406 (39)
HLP	1.3245	1.3215	1.3186	1.3050	1.3024	1.2906	1.2906	1.2884	1.2951	1.3024	1.3076	1.3130 (40)
HLP (average)												1.3050 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)
Energy conte	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Energy content (annual)										Total = Sum(45)m =		1564.5268 (45)
Distribution loss (46)m = 0.15 x (45)m												

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.4692	30.1470	31.1090	27.1216	26.0238	22.4565	20.8093	23.8790	24.1642	28.1610	30.7399	33.3816 (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	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0066	20.4342	16.6182	12.5811	9.4045	7.9397	8.5791	11.1514	14.9674	19.0046	22.1812	23.6460	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.6146	260.2879	253.5514	239.2103	221.1072	204.0928	192.7262	190.0529	196.7894	211.1305	229.2336	246.2480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	(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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	(71)
Water heating gains (Table 5)	46.3296	44.8616	41.8131	37.6688	34.9782	31.1896	27.9695	32.0954	33.5613	37.8508	42.6943	44.8677	(72)
Total internal gains	391.1529	389.7858	376.1849	353.6623	329.6920	307.4243	293.4769	297.5019	309.5203	332.1880	358.3113	378.9638	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	13.1500				10.6334	0.4500	0.0000	0.7700	48.4508 (74)			
South	8.3500				46.7521	0.4500	0.0000	0.7700	135.2666 (78)			
Solar gains	183.7174	314.1237	439.5285	571.6609	672.7939	684.2966	652.7701	573.4432	483.9523	349.1614	220.1073	157.2737 (83)
Total gains	574.8702	703.9095	815.7134	925.3232	1002.4859	991.7208	946.2470	870.9451	793.4726	681.3495	578.4186	536.2375 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0485	59.1807	59.3109	59.9302	60.0475	60.5997	60.5997	60.7031	60.3858	60.0475	59.8107	59.5651	
alpha	4.9366	4.9454	4.9541	4.9953	5.0032	5.0400	5.0400	5.0469	5.0257	5.0032	4.9874	4.9710	
util living area	0.9991	0.9973	0.9918	0.9710	0.9038	0.7540	0.5850	0.6501	0.8822	0.9843	0.9978	0.9994	(86)
MIT	19.6371	19.8116	20.0784	20.4275	20.7398	20.9298	20.9844	20.9742	20.8339	20.4259	19.9639	19.6079	(87)
Th 2	19.8217	19.8240	19.8263	19.8369	19.8389	19.8482	19.8482	19.8500	19.8446	19.8389	19.8349	19.8307	(88)
util rest of house	0.9987	0.9962	0.9883	0.9576	0.8588	0.6519	0.4423	0.5055	0.8097	0.9747	0.9968	0.9991	(89)
MIT 2	18.5882	18.7640	19.0309	19.3805	19.6674	19.8183	19.8449	19.8436	19.7557	19.3854	18.9251	18.5661	(90)
Living area fraction	18.7651	18.9407	19.2075	19.5571	19.8483	20.0057	20.0371	20.0342	19.9375	19.5609	19.1003	18.7418	(91)
MIT	18.7651	18.9407	19.2075	19.5571	19.8483	20.0057	20.0371	20.0342	19.9375	19.5609	19.1003	18.7418	(92)
Temperature adjustment	18.7651	18.9407	19.2075	19.5571	19.8483	20.0057	20.0371	20.0342	19.9375	19.5609	19.1003	18.7418	(93)
adjusted MIT	18.7651	18.9407	19.2075	19.5571	19.8483	20.0057	20.0371	20.0342	19.9375	19.5609	19.1003	18.7418	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9950	0.9858	0.9535	0.8593	0.6674	0.4668	0.5303	0.8168	0.9716	0.9958	0.9987	(94)
Ext temp.	573.8503	700.4025	804.1034	882.2666	861.4023	661.8628	441.6716	461.9021	648.0852	661.9665	575.9824	535.5631	(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	1931.1752	1870.3255	1689.0267	1401.8555	1069.7462	703.2226	447.1222	471.9674	762.0867	1176.4339	1581.6908	1924.5835	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1009.8497	786.1882	658.3829	374.1040	155.0079	0.0000	0.0000	0.0000	0.0000	382.7638	724.1100	1033.4311	(98)
												5123.8377	(98)
												50.8317	(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	1222.8332	962.6559	986.9900	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8481	0.9136	0.8835	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1037.1340	879.4755	872.0250	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1264.6459	1209.2101	1123.0572	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	163.8086	245.3226	186.7679	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												595.8991 (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	40.9521	61.3306	46.6920	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												148.9748 (107)
Space cooling per m2												1.4779 (108)
Energy for space heating												50.8317 (99)
Energy for space cooling												1.4779 (108)
Total												52.3096 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1572 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4072 (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) =					0.3461 (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	0.4413	0.4326	0.4240	0.3807	0.3720	0.3288	0.3288	0.3201	0.3461	0.3720	0.3893	0.4066	(22b)				
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			21.5000	1.3258	28.5038		(27)					
ground			50.4000	0.1300	6.5520		(28a)					
external	145.4400	23.5000	121.9400	0.1800	21.9492		(29a)					
cold	50.4000		50.4000	0.1300	6.5520		(30)					
Total net area of external elements Aum(A, m2)			246.2400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	65.5570		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9695 (36)					
Total fabric heat loss						(33) + (36) =	76.5265 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.1727	Feb 49.8552	Mar 49.5440	Apr 48.0821	May 47.8086	Jun 46.5354	Jul 46.5354	Aug 46.2996	Sep 47.0258	Oct 47.8086	Nov 48.3619	Dec 48.9404 (38)
Heat transfer coeff	126.6992	126.3817	126.0705	124.6086	124.3351	123.0619	123.0619	122.8261	123.5523	124.3351	124.8884	125.4669 (39)
Average = Sum(39)m / 12 =												124.6073 (39)
HLP	Jan 1.2569	Feb 1.2538	Mar 1.2507	Apr 1.2362	May 1.2335	Jun 1.2209	Jul 1.2209	Aug 1.2185	Sep 1.2257	Oct 1.2335	Nov 1.2390	Dec 1.2447 (40)
HLP (average)												1.2362 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)
Energy conte	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Energy content (annual)										Total = Sum(45)m =		1564.5268 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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)
	34.4692	30.1470	31.1090	27.1216	26.0238	22.4565	20.8093	23.8790	24.1642	28.1610	30.7399	33.3816 (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	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	137.3405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0066	20.4342	16.6182	12.5811	9.4045	7.9397	8.5791	11.1514	14.9674	19.0046	22.1812	23.6460	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.6146	260.2879	253.5514	239.2103	221.1072	204.0928	192.7262	190.0529	196.7894	211.1305	229.2336	246.2480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	36.7340	(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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	(71)
Water heating gains (Table 5)	46.3296	44.8616	41.8131	37.6688	34.9782	31.1896	27.9695	32.0954	33.5613	37.8508	42.6943	44.8677	(72)
Total internal gains	391.1529	389.7858	376.1849	353.6623	329.6920	307.4243	293.4769	297.5019	309.5203	332.1880	358.3113	378.9638	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W	
North					13.1500	10.6334	0.6300		0.7000				0.7700			42.7336 (74)
South					8.3500	46.7521	0.6300		0.7000				0.7700			119.3051 (78)
Solar gains	162.0387	277.0571	387.6642	504.2050	593.4042	603.5496	575.7433	505.7769	426.8460	307.9604	194.1347	138.7154	(83)			
Total gains	553.1916	666.8429	763.8491	857.8673	923.0962	910.9738	869.2202	803.2788	736.3662	640.1484	552.4459	517.6793	(84)			

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2490	55.3878	55.5245	56.1759	56.2995	56.8819	56.8819	56.9911	56.6562	56.2995	56.0500	55.7916	
alpha	4.6833	4.6925	4.7016	4.7451	4.7533	4.7921	4.7921	4.7994	4.7771	4.7533	4.7367	4.7194	
util living area	0.9986	0.9964	0.9903	0.9691	0.9048	0.7622	0.5970	0.6591	0.8815	0.9818	0.9970	0.9990	(86)
MIT	19.5712	19.7470	20.0196	20.3795	20.7053	20.9142	20.9792	20.9673	20.8130	20.3901	19.9134	19.5431	(87)
Th 2	19.8747	19.8772	19.8797	19.8912	19.8933	19.9034	19.9034	19.9052	19.8995	19.8933	19.8889	19.8844	(88)
util rest of house	0.9981	0.9951	0.9867	0.9564	0.8643	0.6684	0.4611	0.5232	0.8154	0.9721	0.9957	0.9986	(89)
MIT 2	18.5759	18.7532	19.0259	19.3875	19.6906	19.8631	19.8981	19.8957	19.7928	19.4040	18.9289	18.5555	(90)
Living area fraction	18.7438	18.9208	19.1935	19.5548	19.8617	20.0404	20.0804	20.0765	fLA = Living area / (4) =			0.1687	(91)
MIT	18.7438	18.9208	19.1935	19.5548	19.8617	20.0404	20.0804	20.0765	19.9649	19.5703	19.0949	18.7221	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7438	18.9208	19.1935	19.5548	19.8617	20.0404	20.0804	20.0765	19.9649	19.5703	19.0949	18.7221	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9936	0.9836	0.9515	0.8629	0.6814	0.4842	0.5461	0.8202	0.9683	0.9944	0.9981	(94)
Ext temp.	551.7669	662.5870	751.3295	816.2677	796.5093	620.7466	420.8713	438.6484	603.9568	619.8343	549.3426	516.7019	(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	1830.0150	1771.9695	1600.2757	1327.6783	1014.7855	669.5010	428.3059	451.5652	724.6169	1115.3228	1498.0284	1822.0388	(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	951.0166	745.5050	631.6160	368.2156	162.3975	0.0000	0.0000	0.0000	0.0000	368.6435	683.0538	971.1707	(98)
Space heating per m2												4881.6187	(98)
												48.4288	(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	1156.7818	910.6580	933.4784	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8321	0.9005	0.8704	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	962.5707	820.0379	812.4816	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1170.2664	1119.1787	1043.9667	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	149.5409	222.5607	172.2249	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												544.3266	(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	37.3852	55.6402	43.0562	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											136.0816 (107)
Space cooling per m2											1.3500 (108)
Energy for space heating											48.4288 (99)
Energy for space cooling											1.3500 (108)
Total											49.7788 (109)
Target Fabric Energy Efficiency (TFEE)											57.2 (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	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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												4.7500
Infiltration rate												0.2375 (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) =	0.2019 (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												
	0.2372	0.2221	0.2221	0.2019	0.2069	0.1968	0.1968	0.1918	0.1918	0.2069	0.2019	0.2069 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.0196		(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss						(33) + (36) =	83.8277 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958 (38)
Heat transfer coeff	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235 (39)
Average = Sum(39)m / 12 =												125.8235 (39)
HLP	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482 (40)
HLP (average)												1.2482 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	1564.5268 (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	14.1459	12.7658	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (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	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (64)
RHI water heating demand	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (65)
Heat gains from water heating, kWh/month												
	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5164	51.0855	41.5456	31.4527	23.5112	19.8492	21.4477	27.8786	37.4186	47.5115	55.4529	59.1149 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4994	388.4893	378.4349	357.0302	330.0107	304.6161	287.6510	283.6611	293.7155	315.1202	342.1397	367.5343 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277 (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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724 (71)
Water heating gains (Table 5)	77.2454	74.9443	70.1658	63.6668	59.4454	53.5039	48.4572	54.9270	57.2285	63.9547	71.5471	74.9539 (72)
Total internal gains	631.4251	626.6831	602.3102	564.3135	525.1312	490.1331	469.7197	478.6305	500.5264	538.7502	581.3036	613.7670 (73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	13.1500				13.4684		0.4500		0.0000		0.7700		61.3685 (74)	
South	8.3500				56.5862		0.4500		0.0000		0.7700		163.7195 (78)	
Solar gains	225.0880	328.4238	471.1937	621.7061	693.4721	782.3149	716.3293	653.1752	545.3357	394.7780	268.9414	182.3341 (83)		
Total gains	856.5131	955.1068	1073.5039	1186.0197	1218.6033	1272.4480	1186.0491	1131.8057	1045.8620	933.5282	850.2450	796.1012 (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	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539
alpha	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769
util living area	0.9918	0.9852	0.9626	0.8924	0.7425	0.4970	0.3491	0.3547	0.6425	0.9039	0.9799	0.9939 (86)
MIT	20.0929	20.2111	20.4559	20.7390	20.9257	20.9922	20.9990	20.9990	20.9728	20.7699	20.3939	20.0548 (87)
Th 2	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816 (88)
util rest of house	0.9886	0.9796	0.9482	0.8532	0.6629	0.3918	0.2313	0.2313	0.5288	0.8574	0.9705	0.9915 (89)
MIT 2	19.0895	19.2055	19.4420	19.6992	19.8437	19.8796	19.8815	19.8815	19.8725	19.7326	19.3862	19.0521 (90)
Living area fraction									fLA = Living area / (4) =			0.1687 (91)
MIT	19.2587	19.3751	19.6130	19.8745	20.0262	20.0672	20.0700	20.0700	20.0581	19.9076	19.5561	19.2212 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1087	19.2251	19.4630	19.7245	19.8762	19.9172	19.9200	19.9200	19.9081	19.7576	19.4061	19.0712 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9855	0.9751	0.9414	0.8467	0.6625	0.3952	0.2354	0.2356	0.5317	0.8511	0.9651	0.9889 (94)
Useful gains	844.1032	931.3606	1010.5716	1004.2164	807.3115	502.8914	279.2051	266.6272	556.0391	794.4828	820.5789	787.2988 (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	1699.7101	1664.0293	1492.6390	1210.9939	852.6024	505.4593	279.3249	266.7420	567.2262	963.5019	1359.6632	1682.4084 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	636.5716	492.3534	358.6582	148.8798	33.6964	0.0000	0.0000	0.0000	0.0000	125.7502	388.1407	665.9616 (98)
Space heating												2850.0118 (98)
RHI space heating demand												2850 (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	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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												4.7500
Infiltration rate												0.2375 (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) =	0.2019 (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												
	0.2574	0.2523	0.2473	0.2221	0.2170	0.1918	0.1918	0.1867	0.2019	0.2170	0.2271	0.2372 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5074	0.5023	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.0196		(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss						(33) + (36) =	83.8277 (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	42.6166	42.1927	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958 (38)
Heat transfer coeff	126.4442	126.0203	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235 (39)
Average = Sum(39)m / 12 =												125.8916 (39)
HLP	Jan 1.2544	Feb 1.2502	Mar 1.2482	Apr 1.2482	May 1.2482	Jun 1.2482	Jul 1.2482	Aug 1.2482	Sep 1.2482	Oct 1.2482	Nov 1.2482	Dec 1.2482 (40)
HLP (average)												1.2489 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.5268 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	23.5635 (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	14.1459	12.7658	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (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	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (64)
								Total per year (kWh/year) =	Sum (64)m =			1730.1511 (64)
Heat gains from water heating, kWh/month	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (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	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5164	51.0855	41.5456	31.4527	23.5112	19.8492	21.4477	27.8786	37.4186	47.5115	55.4529	59.1149 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4994	388.4893	378.4349	357.0302	330.0107	304.6161	287.6510	283.6611	293.7155	315.1202	342.1397	367.5343 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277 (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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724 (71)
Water heating gains (Table 5)	77.2454	74.9443	70.1658	63.6668	59.4454	53.5039	48.4572	54.9270	57.2285	63.9547	71.5471	74.9539 (72)
Total internal gains	631.4251	626.6831	602.3102	564.3135	525.1312	490.1331	469.7197	478.6305	500.5264	538.7502	581.3036	613.7670 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					13.1500	10.6334	0.4500	0.0000			0.7700	48.4508 (74)
South					8.3500	46.7521	0.4500	0.0000			0.7700	135.2666 (78)

Solar gains	183.7174	314.1237	439.5285	571.6609	672.7939	684.2966	652.7701	573.4432	483.9523	349.1614	220.1073	157.2737 (83)
Total gains	815.1425	940.8068	1041.8387	1135.9745	1197.9251	1174.4296	1122.4899	1052.0737	984.4787	887.9117	801.4109	771.0408 (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	62.3463	62.5560	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539
util living area	5.1564	5.1704	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769
	0.9955	0.9898	0.9756	0.9333	0.8281	0.6518	0.4867	0.5386	0.7812	0.9525	0.9904	0.9966 (86)
MIT	19.9172	20.0852	20.3265	20.6147	20.8515	20.9669	20.9939	20.9899	20.9174	20.6142	20.2037	19.8784 (87)
Th 2	19.8767	19.8800	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816 (88)
util rest of house	0.9938	0.9861	0.9665	0.9080	0.7686	0.5526	0.3665	0.4138	0.6913	0.9289	0.9862	0.9953 (89)
MIT 2	18.9111	19.0800	19.3174	19.5896	19.7910	19.8686	19.8804	19.8793	19.8425	19.5956	19.1998	18.8765 (90)
Living area fraction	19.0808	19.2495	19.4876	19.7625	19.9699	20.0538	20.0682	20.0666	20.0238	19.7674	19.3691	19.0455 (92)
MIT												0.1687 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.9308	19.0995	19.3376	19.6125	19.8199	19.9038	19.9182	19.9166	19.8738	19.6174	19.2191	18.8955 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9918	0.9826	0.9607	0.9006	0.7649	0.5547	0.3705	0.4178	0.6906	0.9217	0.9827	0.9937 (94)
Ext temp.	808.4374	924.4329	1000.9068	1023.0396	916.2953	651.4147	415.9324	439.5635	679.8666	818.3531	787.5444	766.1637 (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	1849.9764	1789.4280	1615.2706	1347.8853	1021.6693	667.3449	417.5028	442.4715	726.4780	1134.5998	1524.8665	1849.0338 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	774.9050	581.2767	457.0867	233.8889	78.3983	0.0000	0.0000	0.0000	0.0000	235.2875	530.8719	805.6554 (98)
Space heating per m ²												3697.3704 (98)
										(98) / (4) =		36.6803 (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													4085.4921 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	774.9050	581.2767	457.0867	233.8889	78.3983	0.0000	0.0000	0.0000	0.0000	235.2875	530.8719	805.6554	(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)	856.2486	642.2947	505.0682	258.4408	86.6279	0.0000	0.0000	0.0000	0.0000	259.9862	586.5988	890.2269	(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	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233	(64)
Efficiency of water heater	89.8892	89.8083	89.6460	89.2680	88.4409	87.3000	87.3000	87.3000	87.3000	89.2442	89.7443	87.3000	(216)
(217)m	89.8892	89.8083	89.6460	89.2680	88.4409	87.3000	87.3000	87.3000	87.3000	89.2442	89.7443	89.9223	(217)
Fuel for water heating, kWh/month	196.1903	172.1822	179.0410	158.2226	154.3361	136.5609	128.1706	144.7655	145.8103	164.2649	176.4106	190.4126	(219)
Water heating fuel used												1946.3675	(219)
Annual totals kWh/year													
Space heating fuel - main system												4085.4921	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)												67.2054	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												142.2054	(231)
Electricity for lighting (calculated in Appendix L)												406.3029	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.85 * 597 * 1.00) =										-884.0952		-884.0952	(233)
Total delivered energy for all uses												5696.2728	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4085.4921	3.4800	142.1751 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.3675	3.4800	67.7336 (247)
Mechanical ventilation fans	67.2054	13.1900	8.8644 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	406.3029	13.1900	53.5914 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-884.0952	13.1900	-116.6122 (252)
Total energy cost			285.6448 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	0.8228	(257)
SAP value	88.5213	
SAP rating (Section 12)	89	(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	4085.4921	0.2160	882.4663 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.3675	0.2160	420.4154 (264)
Space and water heating			1302.8817 (265)
Pumps and fans	142.2054	0.5190	73.8046 (267)
Energy for lighting	406.3029	0.5190	210.8712 (268)
Energy saving/generation technologies			
PV Unit	-884.0952	0.5190	-458.8454 (269)
Total kg/year			1128.7121 (272)
CO2 emissions per m2			11.2000 (273)
EI value			89.6264
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8876 = 3.921$, stars = 4
Water heating environmental impact	$0.216 / 0.8876 = 0.2433$, 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	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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												4.7500
Infiltration rate												0.2375 (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) =	0.2019 (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												
	0.2372	0.2221	0.2221	0.2019	0.2069	0.1968	0.1968	0.1918	0.1918	0.2069	0.2019	0.2069 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.0196		(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss						(33) + (36) =	83.8277 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958 (38)
Heat transfer coeff	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235 (39)
Average = Sum(39)m / 12 =												125.8235 (39)
HLP	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482 (40)
HLP (average)												1.2482 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.5268 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	23.5635 (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	14.1459	12.7658	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (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	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (64)
Heat gains from water heating, kWh/month	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (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	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5164	51.0855	41.5456	31.4527	23.5112	19.8492	21.4477	27.8786	37.4186	47.5115	55.4529	59.1149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4994	388.4893	378.4349	357.0302	330.0107	304.6161	287.6510	283.6611	293.7155	315.1202	342.1397	367.5343	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	(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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	(71)
Water heating gains (Table 5)	77.2454	74.9443	70.1658	63.6668	59.4454	53.5039	48.4572	54.9270	57.2285	63.9547	71.5471	74.9539	(72)
Total internal gains	631.4251	626.6831	602.3102	564.3135	525.1312	490.1331	469.7197	478.6305	500.5264	538.7502	581.3036	613.7670	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d					Gains W
North					13.1500	13.4684	0.4500	0.0000	0.7700					61.3685
South					8.3500	56.5862	0.4500	0.0000	0.7700					163.7195 (74)

Solar gains	225.0880	328.4238	471.1937	621.7061	693.4721	782.3149	716.3293	653.1752	545.3357	394.7780	268.9414			182.3341 (83)
Total gains	856.5131	955.1068	1073.5039	1186.0197	1218.6033	1272.4480	1186.0491	1131.8057	1045.8620	933.5282	850.2450			796.1012 (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	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	
alpha	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	
util living area	0.9918	0.9852	0.9626	0.8924	0.7425	0.4970	0.3491	0.3547	0.6425	0.9039	0.9799	0.9939	(86)
MIT	20.0929	20.2111	20.4559	20.7390	20.9257	20.9922	20.9990	20.9990	20.9728	20.7699	20.3939	20.0548	(87)
Th 2	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	(88)
util rest of house	0.9886	0.9796	0.9482	0.8532	0.6629	0.3918	0.2313	0.2313	0.5288	0.8574	0.9705	0.9915	(89)
MIT 2	19.0895	19.2055	19.4420	19.6992	19.8437	19.8796	19.8815	19.8815	19.8725	19.7326	19.3862	19.0521	(90)
Living area fraction	19.2587	19.3751	19.6130	19.8745	20.0262	20.0672	20.0700	20.0700	fLA = Living area / (4) =	19.9076	19.5561	19.2212	(91)
MIT	19.1087	19.2251	19.4630	19.7245	19.8762	19.9172	19.9200	19.9200	20.0581	19.9076	19.5561	19.2212	(92)
Temperature adjustment												-0.1500	
adjusted MIT												19.0712	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9855	0.9751	0.9414	0.8467	0.6625	0.3952	0.2354	0.2356	0.5317	0.8511	0.9651	0.9889	(94)
Ext temp.	844.1032	931.3606	1010.5716	1004.2164	807.3115	502.8914	279.2051	266.6272	556.0391	794.4828	820.5789	787.2988	(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	1699.7101	1664.0293	1492.6390	1210.9939	852.6024	505.4593	279.3249	266.7420	567.2262	963.5019	1359.6632	1682.4084	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	636.5716	492.3534	358.6582	148.8798	33.6964	0.0000	0.0000	0.0000	0.0000	125.7502	388.1407	665.9616	(98)
												2850.0118	(98)
										(98) / (4) =		28.2739	(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												3149.1843	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	636.5716	492.3534	358.6582	148.8798	33.6964	0.0000	0.0000	0.0000	0.0000	125.7502	388.1407	665.9616	(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)	703.3940	544.0369	396.3074	164.5081	37.2336	0.0000	0.0000	0.0000	0.0000	138.9505	428.8847	735.8692	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233	(64)
Efficiency of water heater	89.7860	89.7140	89.4859	88.9133	87.9155	87.3000	87.3000	87.3000	87.3000	88.7489	89.5490	89.8266	(216)
(217)m	89.7860	89.7140	89.4859	88.9133	87.9155	87.3000	87.3000	87.3000	87.3000	88.7489	89.5490	89.8266	(217)
Fuel for water heating, kWh/month	196.4157	172.3631	179.3613	158.8538	155.2584	136.5609	128.1706	144.7655	145.8103	165.1816	176.7953	190.6154	(219)
Water heating fuel used												1950.1518	(219)
Annual totals kWh/year													
Space heating fuel - main system												3149.1843	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)												67.2054	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												142.2054	(231)
Electricity for lighting (calculated in Appendix L)												406.3029	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.85 * 696 * 1.00) =										-1030.5556		-1030.5556	(233)
Total delivered energy for all uses												4617.2889	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3149.1843	10.2300	322.1616 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1950.1518	10.2300	199.5005 (247)
Mechanical ventilation fans	67.2054	36.7200	24.6778 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	406.3029	36.7200	149.1944 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-1030.5556	36.7200	-378.4200 (252)
Total energy cost			447.6543 (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	3149.1843	0.2160	680.2238 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1950.1518	0.2160	421.2328 (264)
Space and water heating			1101.4566 (265)
Pumps and fans	142.2054	0.5190	73.8046 (267)
Energy for lighting	406.3029	0.5190	210.8712 (268)
Energy saving/generation technologies			
PV Unit	-1030.5556	0.5190	-534.8583 (269)
Total kg/year			851.2741 (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	3149.1843	1.2200	3842.0048 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1950.1518	1.2200	2379.1852 (264)
Space and water heating			6221.1901 (265)
Pumps and fans	142.2054	3.0700	436.5705 (267)
Energy for lighting	406.3029	3.0700	1247.3500 (268)
Energy saving/generation technologies			
PV Unit	-1030.5556	3.0700	-3163.8056 (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

4741.3051 (272)
47.0368 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 86	-194 kg (22.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£86 1.92 kg/m ²	B 90	B 91
Total Savings	£86 1.92 kg/m ²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 526 TEST (30 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	£201	£220	-£18
Mains gas	£625	£521	£104
Space heating	£477	£477	£0
Water heating	£200	£114	£86
Lighting	£149	£149	£0
Generated (PV)	-£378	-£378	£0
Total cost of fuels	£448	£363	£86
Total cost of uses	£448	£362	£86
Delivered energy	46 kWh/m ²	36 kWh/m ²	10 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m ²	8 kg/m ²	7 kg/m ²	2 kg/m ²
Primary energy	47 kWh/m ²	36 kWh/m ²	11 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	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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												4.7500
Infiltration rate												0.2375 (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) =	0.2019 (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												
	0.2574	0.2523	0.2473	0.2221	0.2170	0.1918	0.1918	0.1867	0.2019	0.2170	0.2271	0.2372 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5074	0.5023	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.0196		(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss						(33) + (36) =	83.8277 (37)

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

(38)m	Jan 42.6166	Feb 42.1927	Mar 41.9958	Apr 41.9958	May 41.9958	Jun 41.9958	Jul 41.9958	Aug 41.9958	Sep 41.9958	Oct 41.9958	Nov 41.9958	Dec 41.9958 (38)
Heat transfer coeff	126.4442	126.0203	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235 (39)
Average = Sum(39)m / 12 =												125.8916 (39)
HLP	Jan 1.2544	Feb 1.2502	Mar 1.2482	Apr 1.2482	May 1.2482	Jun 1.2482	Jul 1.2482	Aug 1.2482	Sep 1.2482	Oct 1.2482	Nov 1.2482	Dec 1.2482 (40)
HLP (average)												1.2489 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	23.5635 (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	14.1459	12.7658	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (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												1.1592 (H8)
Utilisation factor												0.5780 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4367 (H14)
Volume ratio Veff/V												0.7542 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-869.6826 (H17)
Solar input	-25.2191	-42.0834	-71.6728	-96.0557	-118.6687	-116.6702	-115.1284	-100.5882	-78.7808	-53.7980	-29.9134	-21.1040 (63)
Solar input (sum of months) = Sum (63)m =												-869.6826 (63)
Output from w/h	151.1348	112.5505	88.8303	45.1865	17.8275	2.5474	0.0000	25.7920	48.5117	92.7990	128.4050	150.1193 (64)
Total per year (kWh/year) = Sum (64)m =												863.7039 (64)
Heat gains from water heating, kWh/month	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (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	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5164	51.0855	41.5456	31.4527	23.5112	19.8492	21.4477	27.8786	37.4186	47.5115	55.4529	59.1149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4994	388.4893	378.4349	357.0302	330.0107	304.6161	287.6510	283.6611	293.7155	315.1202	342.1397	367.5343	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	(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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	(71)
Water heating gains (Table 5)	77.2454	74.9443	70.1658	63.6668	59.4454	53.5039	48.4572	54.9270	57.2285	63.9547	71.5471	74.9539	(72)
Total internal gains	631.4251	626.6831	602.3102	564.3135	525.1312	490.1331	469.7197	478.6305	500.5264	538.7502	581.3036	613.7670	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
North					13.1500	10.6334	0.4500	0.0000	0.7700			48.4508
South					8.3500	46.7521	0.4500	0.0000	0.7700			135.2666 (74)

Solar gains	183.7174	314.1237	439.5285	571.6609	672.7939	684.2966	652.7701	573.4432	483.9523	349.1614	220.1073	157.2737 (83)
Total gains	815.1425	940.8068	1041.8387	1135.9745	1197.9251	1174.4296	1122.4899	1052.0737	984.4787	887.9117	801.4109	771.0408 (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	62.3463	62.5560	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	
util living area	5.1564	5.1704	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	
	0.9955	0.9898	0.9756	0.9333	0.8281	0.6518	0.4867	0.5386	0.7812	0.9525	0.9904	0.9966	(86)
MIT	19.9172	20.0852	20.3265	20.6147	20.8515	20.9669	20.9939	20.9899	20.9174	20.6142	20.2037	19.8784	(87)
Th 2	19.8767	19.8800	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	(88)
util rest of house	0.9938	0.9861	0.9665	0.9080	0.7686	0.5526	0.3665	0.4138	0.6913	0.9289	0.9862	0.9953	(89)
MIT 2	18.9111	19.0800	19.3174	19.5896	19.7910	19.8686	19.8804	19.8793	19.8425	19.5956	19.1998	18.8765	(90)
Living area fraction									fLA = Living area / (4) =			0.1687	(91)
MIT	19.0808	19.2495	19.4876	19.7625	19.9699	20.0538	20.0682	20.0666	20.0238	19.7674	19.3691	19.0455	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9308	19.0995	19.3376	19.6125	19.8199	19.9038	19.9182	19.9166	19.8738	19.6174	19.2191	18.8955	(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	0.9918	0.9826	0.9607	0.9006	0.7649	0.5547	0.3705	0.4178	0.6906	0.9217	0.9827	0.9937	(94)
Useful gains	808.4374	924.4329	1000.9068	1023.0396	916.2953	651.4147	415.9324	439.5635	679.8666	818.3531	787.5444	766.1637	(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	1849.9764	1789.4280	1615.2706	1347.8853	1021.6693	667.3449	417.5028	442.4715	726.4780	1134.5998	1524.8665	1849.0338	(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	774.9050	581.2767	457.0867	233.8889	78.3983	0.0000	0.0000	0.0000	0.0000	235.2875	530.8719	805.6554	(98)
Space heating													
Space heating per m2													(98) / (4) = 36.6803 (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													4085.4921 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	774.9050	581.2767	457.0867	233.8889	78.3983	0.0000	0.0000	0.0000	0.0000	235.2875	530.8719	805.6554	(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)	856.2486	642.2947	505.0682	258.4408	86.6279	0.0000	0.0000	0.0000	0.0000	259.9862	586.5988	890.2269	(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	151.1348	112.5505	88.8303	45.1865	17.8275	2.5474	0.0000	25.7920	48.5117	92.7990	128.4050	150.1193	(64)
Efficiency of water heater	89.9618	89.9651	89.9634	89.9660	89.8896	87.3000	87.3000	87.3000	87.3000	89.5713	89.8585	89.9819	(216)
(217)m	167.9988	125.1047	98.7405	50.2262	19.8326	2.9180	0.0000	29.5441	55.5689	103.6034	142.8969	166.8327	(219)
Fuel for water heating, kWh/month													
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													4085.4921 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)													67.2054 (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													192.2054 (231)
Electricity for lighting (calculated in Appendix L)													406.3029 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.85 * 597 * 1.00) =													-884.0952 (233)
Total delivered energy for all uses													4763.1721 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4085.4921	3.4800	142.1751	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	963.2668	3.4800	33.5217	(247)
Mechanical ventilation fans	67.2054	13.1900	8.8644	(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	406.3029	13.1900	53.5914	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-884.0952	13.1900	-116.6122	(252)
Total energy cost			258.0279	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.7433 (257)
SAP value			89.6311
SAP rating (Section 12)			90 (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	4085.4921	0.2160	882.4663 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	963.2668	0.2160	208.0656 (264)
Space and water heating			1090.5319 (265)
Pumps and fans	192.2054	0.5190	99.7546 (267)
Energy for lighting	406.3029	0.5190	210.8712 (268)
Energy saving/generation technologies			
PV Unit	-884.0952	0.5190	-458.8454 (269)
Total kg/year			942.3124 (272)
CO2 emissions per m2			9.3500 (273)
EI value			91.3395
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.4500 (2b)	= 123.4800 (1b) - (3b)
First floor	50.4000 (1c)	x 2.6000 (2c)	= 131.0400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 254.5200 (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											4.7500		
Infiltration rate											0.2375	(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) =		0.2019	(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													
	0.2372	0.2221	0.2221	0.2019	0.2069	0.1968	0.1968	0.1918	0.1918	0.2069	0.2019	0.2069 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			21.5000	1.3258	28.5038		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	23.5000	121.9400	0.2700	32.9238	150.0000	18291.0004 (29a)
cold	50.4000		50.4000	0.1100	5.5440	9.0000	453.6000 (30)
Total net area of external elements Aum(A, m ²)			246.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.0196		(33)
stud			179.4000			9.0000	1614.5999 (32c)
block			38.4000			75.0000	2880.0001 (32c)
internal			50.4000			18.0000	907.2000 (32d)
internal			50.4000			9.0000	453.6000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 28380.0006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.5476 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8081 (36)
Total fabric heat loss							(33) + (36) = 83.8277 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958	41.9958 (38)
Heat transfer coeff	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235	125.8235 (39)
Average = Sum(39)m / 12 =												125.8235 (39)
HLP	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482	1.2482 (40)
HLP (average)												1.2482 (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												2.7468 (42)
Average daily hot water use (litres/day)												99.4367 (43)
Daily hot water use	Jan 109.3804	Feb 105.4029	Mar 101.4255	Apr 97.4480	May 93.4705	Jun 89.4930	Jul 89.4930	Aug 93.4705	Sep 97.4480	Oct 101.4255	Nov 105.4029	Dec 109.3804 (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)	162.2080	141.8681	146.3952	127.6309	122.4649	105.6779	97.9261	112.3716	113.7137	132.5223	144.6585	157.0897 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3312	21.2802	21.9593	19.1446	18.3697	15.8517	14.6889	16.8557	17.0571	19.8783	21.6988	23.5635 (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	14.1459	12.7658	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3538	154.6339	160.5031	141.2422	136.4961	119.2176	111.8930	126.3802	127.2924	146.5969	158.3185	171.2233 (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												1.2950 (H8)
Utilisation factor												0.5380 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4367 (H14)
Volume ratio Veff/V												0.7542 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-904.3991 (H17)
Solar input	-29.5117	-41.9690	-72.8269	-97.9645	-113.8414	-123.8264	-117.4063	-107.0632	-83.7981	-57.9182	-34.9056	-23.3678 (63)
Solar input (sum of months) = Sum (63)m =												-904.3991 (63)
Output from w/h	146.8421	112.6649	87.6762	43.2777	22.6548	0.0000	0.0000	19.3171	43.4943	88.6787	123.4128	147.8555 (64)
Total per year (kWh/year) = Sum (64)m =												835.8741 (64)
Heat gains from water heating, kWh/month	57.4706	50.3626	52.2034	45.8401	44.2274	38.5228	36.0521	40.8657	41.2045	47.5823	51.5139	55.7657 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086	164.8086 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.5164	51.0855	41.5456	31.4527	23.5112	19.8492	21.4477	27.8786	37.4186	47.5115	55.4529	59.1149 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4994	388.4893	378.4349	357.0302	330.0107	304.6161	287.6510	283.6611	293.7155	315.1202	342.1397	367.5343 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277	54.2277 (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)	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724	-109.8724 (71)
Water heating gains (Table 5)	77.2454	74.9443	70.1658	63.6668	59.4454	53.5039	48.4572	54.9270	57.2285	63.9547	71.5471	74.9539 (72)
Total internal gains	631.4251	626.6831	602.3102	564.3135	525.1312	490.1331	469.7197	478.6305	500.5264	538.7502	581.3036	613.7670 (73)

6. Solar gains

[Jan]												
			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
North			13.1500	13.4684	0.4500	0.0000	0.7700	61.3685 (74)				
South			8.3500	56.5862	0.4500	0.0000	0.7700	163.7195 (78)				
Solar gains	225.0880	328.4238	471.1937	621.7061	693.4721	782.3149	716.3293	653.1752	545.3357	394.7780	268.9414	182.3341 (83)
Total gains	856.5131	955.1068	1073.5039	1186.0197	1218.6033	1272.4480	1186.0491	1131.8057	1045.8620	933.5282	850.2450	796.1012 (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	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539	62.6539
alpha	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769	5.1769
util living area	0.9918	0.9852	0.9626	0.8924	0.7425	0.4970	0.3491	0.3547	0.6425	0.9039	0.9799	0.9939 (86)
MIT	20.0929	20.2111	20.4559	20.7390	20.9257	20.9922	20.9990	20.9990	20.9728	20.7699	20.3939	20.0548 (87)
Th 2	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816	19.8816 (88)
util rest of house	0.9886	0.9796	0.9482	0.8532	0.6629	0.3918	0.2313	0.2313	0.5288	0.8574	0.9705	0.9915 (89)
MIT 2	19.0895	19.2055	19.4420	19.6992	19.8437	19.8796	19.8815	19.8815	19.8725	19.7326	19.3862	19.0521 (90)
Living area fraction									fLA = Living area / (4) =			0.1687 (91)
MIT	19.2587	19.3751	19.6130	19.8745	20.0262	20.0672	20.0700	20.0700	20.0581	19.9076	19.5561	19.2212 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1087	19.2251	19.4630	19.7245	19.8762	19.9172	19.9200	19.9200	19.9081	19.7576	19.4061	19.0712 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9751	0.9414	0.8467	0.6625	0.3952	0.2354	0.2356	0.5317	0.8511	0.9651	0.9889	(94)
Useful gains	844.1032	931.3606	1010.5716	1004.2164	807.3115	502.8914	279.2051	266.6272	556.0391	794.4828	820.5789	787.2988	(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	1699.7101	1664.0293	1492.6390	1210.9939	852.6024	505.4593	279.3249	266.7420	567.2262	963.5019	1359.6632	1682.4084	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	636.5716	492.3534	358.6582	148.8798	33.6964	0.0000	0.0000	0.0000	0.0000	125.7502	388.1407	665.9616	(98)
Space heating												2850.0118	(98)
Space heating per m2												(98) / (4) =	28.2739 (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													3149.1843 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	636.5716	492.3534	358.6582	148.8798	33.6964	0.0000	0.0000	0.0000	0.0000	125.7502	388.1407	665.9616	(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)	703.3940	544.0369	396.3074	164.5081	37.2336	0.0000	0.0000	0.0000	0.0000	138.9505	428.8847	735.8692	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.8421	112.6649	87.6762	43.2777	22.6548	0.0000	0.0000	19.3171	43.4943	88.6787	123.4128	147.8555	(64)
Efficiency of water heater	89.8825	89.8864	89.8530	89.7590	89.1857	87.3000	87.3000	87.3000	87.3000	89.1486	89.7067	89.9013	(216)
(217)m	163.3713	125.3414	97.5773	48.2154	25.4018	0.0000	0.0000	22.1272	49.8217	99.4729	137.5737	164.4643	(219)
Fuel for water heating, kWh/month												933.3669	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												3149.1843	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.0080, total flow = 37.0000, SFP = 0.2164)													
mechanical ventilation fans (SFP = 0.2164)													67.2054 (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													192.2054 (231)
Electricity for lighting (calculated in Appendix L)													406.3029 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.85 * 696 * 1.00) =										-1030.5556		-1030.5556	(233)
Total delivered energy for all uses												3650.5040	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3149.1843	10.2300	322.1616	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	933.3669	10.2300	95.4834	(247)
Mechanical ventilation fans	67.2054	36.7200	24.6778	(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	406.3029	36.7200	149.1944	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1030.5556	36.7200	-378.4200	(252)
Total energy cost			361.9972	(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	3149.1843	0.2160	680.2238	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	933.3669	0.2160	201.6073	(264)
Space and water heating			881.8311	(265)
Pumps and fans	192.2054	0.5190	99.7546	(267)
Energy for lighting	406.3029	0.5190	210.8712	(268)

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Energy saving/generation technologies			
PV Unit	-1030.5556	0.5190	-534.8583 (269)
Total kg/year			657.5986 (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	3149.1843	1.2200	3842.0048 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	933.3669	1.2200	1138.7077 (264)
Space and water heating			4980.7125 (265)
Pumps and fans	192.2054	3.0700	590.0705 (267)
Energy for lighting	406.3029	3.0700	1247.3500 (268)
Energy saving/generation technologies			
PV Unit	-1030.5556	3.0700	-3163.8056 (269)
Primary energy kWh/year			3654.3275 (272)
Primary energy kWh/m2/year			36.2532 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	281.5 (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	335.97 (P1)
Transmission heat loss coefficient	83.83 (37)
Summer heat loss coefficient	419.79 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	13.1500	87.1704	0.4500	0.0000	0.9000	464.2480
South	8.3500	118.5567	0.4500	0.0000	0.9000	400.9290
total:						865.1770

	Jun	Jul	Aug	
Solar gains	930	865	772	(P4)
Internal gains	487	467	476	
Total summer gains	1417	1332	1247	(P5)

	3.38	3.17	2.97	(P6)
Summer gain/loss ratio				
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 281.5)	0.03	0.03	0.03	
Threshold temperature	18.81	20.50	20.30	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 89	Issued on Date	29/09/2023
Assessment Reference	89 Hamblewood	Prop Type Ref	21809
Property	7 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	89 B	DER	13.13
Environmental	90 B	TER	18.12
CO ₂ Emissions (t/year)	0.85	% DER<TER	27.55
General Requirements Compliance	Pass	DFEE	52.31
		TFEE	57.25
		% DFEE<TFEE	8.62
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)	18.12	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.13	kgCO ₂ /m ²	Pass
	-4.99 (-27.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.25	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	52.31	kWh/m ² /yr	
	-4.9 (-8.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.37 (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	4.75 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

13.15 m², No overhang

Windows facing South

8.35 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.75 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Thermal bridging γ -value

0.036

W/m²K

Photovoltaic array

1.85

kW

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 89	Issued on Date	29/09/2023
Assessment Reference	89 Hamblewood	Prop Type Ref	21809
Property	7 Hickory Way, Hedge End, Southampton, SO30 0AW		
SAP Rating	89 B	DER	13.13
Environmental	90 B	TER	18.12
CO ₂ Emissions (t/year)	0.85	% DER<TER	27.55
General Requirements Compliance	Pass	DFEE	52.31
		TFEE	57.25
		% DFEE<TFEE	8.62
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	South						
Property Tenure	Owner-occupied						
Transaction Type	Marketed sale						
Terrain Type	Suburban						
1.0 Property Type	House, Detached						
2.0 Number of Storeys	2						
3.0 Date Built	2021						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
		Ground Floor:	1.00 m	50.40 m ²	2.45 m		
		1st Storey:	1.00 m	50.40 m ²	2.60 m		
7.0 Living Area	17.00			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	281.55			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	145.44	121.94
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
stud	Plasterboard on timber frame				9.00	179.40	
block	Dense block, plasterboard on dabs				75.00	38.40	
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cold	External Plane Roof	Plasterboard, insulated at ceiling level		0.11	9.00	50.40	50.40
10.2 Internal Ceilings							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
internal	Other				9.00	50.40	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	50.40

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	50.40

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	South							2.00	
front	Window	[1] external	South	None	0.00					8.35	
rear	Window	[1] external	North	None	0.00					13.15	

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)	15.85	0.300	No
Independently assessed	E3 Sill	10.10	0.015	No
Independently assessed	E4 Jamb	33.60	0.011	No
Independently assessed	E5 Ground floor (normal)	28.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	28.80	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.90	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	12.20	0.063	No
Independently assessed	E16 Corner (normal)	20.20	0.067	No

Y-value 0.036 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.01	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.75	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

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation -

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

	decentralised
MV Reference Number	500229
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	27	
Total number of L.E.L. fittings	27	
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	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.85	North	45°	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	£86	B 90	