

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 76	Issued on Date	03/11/2023
Assessment Reference	plot 76 way	Prop Type Ref	21809
Property	12 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	13.97
Environmental	89 B	TER	17.47
CO ₂ Emissions (t/year)	0.98	% DER<TER	20.04
General Requirements Compliance	Pass	DFEE	48.26
		TFEE	53.42
		% DFEE<TFEE	9.65
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
Client	Y128-0001		

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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) 17.47 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.97 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.3 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	1.36 (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: 3.98 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North: 1.30 m², No overhang
Windows facing East: 4.70 m², No overhang
Windows facing South: 8.35 m², No overhang
Windows facing West: 2.80 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 0.033 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 1.20 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												3.9800
Infiltration rate												0.1990 (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) =	0.1692 (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												
	0.2157	0.2114	0.2072	0.1861	0.1818	0.1607	0.1607	0.1565	0.1692	0.1818	0.1903	0.1988 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =	70.4270			(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) = 29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss						(33) + (36) =	78.6660 (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	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618 (39)
Average = Sum(39)m / 12 =												120.6618 (39)
HLP	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970 (40)
HLP (average)												1.1970 (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	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)

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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	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)
Solar input (sum of months) = Sum (63)m =												
Total per year (kWh/year) = Sum (64)m =												

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	23.6834	21.0354	17.1071	12.9512	9.6812	8.1733	8.8315	11.4795	15.4078	19.5637	22.8337	24.3417 (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	425.7456	423.4697	408.0265	383.0304	357.4359	332.9721	317.2170	323.6616	336.6277	361.8511	390.8166	412.7457 (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			1.3000	10.6334	0.4500	0.0000	0.7700	4.7898 (74)				
East			4.7000	19.6403	0.4500	0.0000	0.7700	31.9851 (76)				
South			8.3500	46.7521	0.4500	0.0000	0.7700	135.2666 (78)				
West			2.8000	19.6403	0.4500	0.0000	0.7700	19.0550 (80)				
Solar gains	191.0965	330.5307	462.1774	583.7353	659.9090	656.7332	632.5759	576.2151	504.7243	368.3139	229.8869	162.8487 (83)
Total gains	616.8422	754.0004	870.2039	966.7657	1017.3449	989.7053	949.7929	899.8767	841.3521	730.1650	620.7036	575.5944 (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	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362
alpha	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557
util living area	0.9989	0.9965	0.9887	0.9617	0.8834	0.7248	0.5484	0.5991	0.8406	0.9775	0.9972	0.9993 (86)
MIT	19.8454	20.0167	20.2661	20.5623	20.8155	20.9547	20.9917	20.9868	20.8966	20.5534	20.1265	19.8016 (87)
Th 2	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224 (88)
util rest of house	0.9985	0.9951	0.9841	0.9451	0.8343	0.6260	0.4199	0.4681	0.7601	0.9646	0.9959	0.9990 (89)
MIT 2	18.8748	19.0455	19.2924	19.5787	19.8040	19.9036	19.9206	19.9193	19.8704	19.5753	19.1556	18.8311 (90)
Living area fraction	19.0385	19.2093	19.4566	19.7446	19.9746	20.0809	20.1013	20.0993	20.0434	19.7402	19.3193	18.9948 (92)
MIT	18.8885	19.0593	19.3066	19.5946	19.8246	19.9309	19.9513	19.9493	19.8934	19.5902	19.1693	18.8448 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	615.5278	749.1179	853.2143	907.3905	843.3986	620.3629	402.1606	424.3261	637.3761	700.3120	617.2935	574.7402 (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	1760.2776	1708.4898	1545.2715	1290.4321	980.3331	643.2362	404.3705	428.2653	699.0456	1084.7769	1456.3055	1767.0661 (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	851.6939	644.6979	514.8905	275.7899	101.8792	0.0000	0.0000	0.0000	0.0000	286.0419	604.0886	887.0904 (98)
Space heating												4166.1724 (98)
Space heating per m2												41.3311 (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	4603.5054 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	851.6939	644.6979	514.8905	275.7899	101.8792	0.0000	0.0000	0.0000	0.0000	286.0419	604.0886	887.0904 (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)	941.0982	712.3734	568.9398	304.7403	112.5737	0.0000	0.0000	0.0000	0.0000	316.0684	667.5013	980.2104 (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	89.9345	89.8628	89.7185	89.3903	88.6395	87.3000	87.3000	87.3000	87.3000	89.3897	89.8163	87.3000 (216)
Fuel for water heating, kWh/month	196.0914	172.0778	178.8964	158.0062	153.9901	136.5609	128.1706	144.7655	145.8103	163.9975	176.2691	190.3191 (219)
Water heating fuel used	1944.9549 (219)											
Annual totals kWh/year												
Space heating fuel - main system	4603.5054 (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)	418.2565 (232)											
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 + 1.20 + 597 + 1.00) =	-573.4671											
Total delivered energy for all uses	6535.4551 (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	4603.5054	0.2160	994.3572 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.9549	0.2160	420.1103 (264)
Space and water heating			1414.4674 (265)
Pumps and fans	142.2054	0.5190	73.8046 (267)
Energy for lighting	418.2565	0.5190	217.0751 (268)
Energy saving/generation technologies			
PV Unit	-573.4671	0.5190	-297.6294 (269)
Total CO2, kg/year			1407.7177 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9700 (273)

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

DER	13.9700	ZC1
Total Floor Area	100.8000	TFA
Assumed number of occupants	2.7468	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.1445	ZC2
CO2 emissions from cooking, equation (L16)	1.8346	ZC3
Total CO2 emissions	30.9491	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	30.9491	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)			17.1500	1.3258	22.7367		(27)					
ground			50.4000	0.1300	6.5520		(28a)					
external	145.4400	19.1500	126.2900	0.1800	22.7322		(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) =		60.5729		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8020 (36)					
Total fabric heat loss						(33) + (36) =	71.3749 (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	121.5477	121.2302	120.9189	119.4571	119.1836	117.9103	117.9103	117.6746	118.4008	119.1836	119.7369	120.3153 (39)
Average = Sum(39)m / 12 =												119.4558 (39)
HLP	Jan 1.2058	Feb 1.2027	Mar 1.1996	Apr 1.1851	May 1.1824	Jun 1.1697	Jul 1.1697	Aug 1.1674	Sep 1.1746	Oct 1.1824	Nov 1.1879	Dec 1.1936 (40)
HLP (average)												1.1851 (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												
	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)
	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	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)
Heat gains from water heating, kWh/month	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	23.6834	21.0354	17.1071	12.9512	9.6812	8.1733	8.8315	11.4795	15.4078	19.5637	22.8337	24.3417	(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	438.1156	435.8438	420.4092	394.9906	368.7263	343.5950	327.8479	334.9596	348.5992	374.2450	403.1969	425.1198	(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			1.3000		10.6334		0.6300		0.7000		0.7700		4.2246 (74)
East			4.7000		19.6403		0.6300		0.7000		0.7700		28.2109 (76)
South			8.3500		46.7521		0.6300		0.7000		0.7700		119.3051 (78)
West			2.8000		19.6403		0.6300		0.7000		0.7700		16.8065 (80)
Solar gains	168.5471	291.5281	407.6405	514.8545	582.0397	579.2387	557.9319	508.2217	445.1669	324.8528	202.7603		143.6326 (83)
Total gains	606.6627	727.3719	828.0497	909.8451	950.7660	922.8336	885.7799	843.1813	793.7661	699.0979	605.9571		568.7524 (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	57.5906	57.7414	57.8900	58.5985	58.7329	59.3671	59.3671	59.4861	59.1212	58.7329	58.4615	58.1804	
alpha	4.8394	4.8494	4.8593	4.9066	4.9155	4.9578	4.9578	4.9657	4.9414	4.9155	4.8974	4.8787	
util living area	0.9980	0.9948	0.9860	0.9591	0.8878	0.7390	0.5679	0.6146	0.8434	0.9730	0.9955	0.9985	(86)
MIT	19.6862	19.8665	20.1350	20.4697	20.7552	20.9326	20.9853	20.9785	20.8632	20.4819	20.0181	19.6565	(87)
Th 2	19.9153	19.9179	19.9203	19.9319	19.9341	19.9443	19.9443	19.9462	19.9404	19.9341	19.9297	19.9251	(88)
util rest of house	0.9973	0.9929	0.9810	0.9434	0.8438	0.6464	0.4407	0.4872	0.7697	0.9595	0.9936	0.9980	(89)
MIT 2	18.1686	18.4332	18.8243	19.3089	19.6912	19.8986	19.9389	19.9373	19.8309	19.3350	18.6638	18.1321	(90)
Living area fraction	18.4246	18.6750	19.0453	19.5046	19.8706	20.0730	20.1153	20.1129	20.0050	19.5284	18.8922	18.3892	(92)
Temperature adjustment	18.4246	18.6750	19.0453	19.5046	19.8706	20.0730	20.1153	20.1129	20.0050	19.5284	18.8922	18.3892	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	604.1024	720.0206	807.6170	850.9745	799.3504	607.9401	409.3300	428.7096	615.1038	665.9240	600.4274	566.9710	(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	1716.8107	1669.9408	1516.9670	1266.7996	973.8051	645.3187	414.4953	436.9157	699.1574	1064.1178	1411.9572	1707.1804	(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	827.8550	638.3464	527.7564	299.3941	129.7943	0.0000	0.0000	0.0000	0.0000	296.2562	584.3015	848.3157	(98)
Space heating												4152.0195	(98)
Space heating per m2												41.1907	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4445.4170 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	827.8550	638.3464	527.7564	299.3941	129.7943	0.0000	0.0000	0.0000	0.0000	296.2562	584.3015	848.3157	(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)	886.3543	683.4544	565.0497	320.5504	138.9661	0.0000	0.0000	0.0000	0.0000	317.1908	625.5905	908.2610	(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 (217)m	88.1302	87.8862	87.4078	86.3821	84.3802	80.3000	80.3000	80.3000	80.3000	86.2509	87.6522	88.2148	(216)
Fuel for water heating, kWh/month	241.8772	213.7942	225.7856	203.3841	201.5832	186.5647	178.7432	199.2567	201.4573	212.7297	221.2990	235.8433	(219)
Water heating fuel used												2522.3183	(219)
Annual totals kWh/year													
Space heating fuel - main system												4445.4170	(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)												418.2565	(232)
Total delivered energy for all uses												7460.9918	(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	4445.4170	0.2160	960.2101 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2522.3183	0.2160	544.8207 (264)
Space and water heating			1505.0308 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	418.2565	0.5190	217.0751 (268)
Total CO2, kg/m2/year			1761.0310 (272)
Emissions per m2 for space and water heating			14.9309 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1535 (272b)
Emissions per m2 for pumps and fans			0.3862 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9309 * 1.00) + 2.1535 + 0.3862, rounded to 2 d.p.			17.4700 (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 heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1572 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3562 (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) =				0.3027 (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	0.3860	0.3784	0.3709	0.3330	0.3254	0.2876	0.2876	0.2800	0.3027	0.3254	0.3406	0.3557 (22b)
Effective ac	0.5745	0.5716	0.5688	0.5554	0.5530	0.5414	0.5414	0.5392	0.5458	0.5530	0.5580	0.5633 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =	70.4270		(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) =	29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss						(33) + (36) =	78.6660 (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	48.2526	48.0096	47.7715	46.6529	46.4436	45.4694	45.4694	45.2890	45.8446	46.4436	46.8670	47.3096 (38)
Heat transfer coeff	126.9186	126.6757	126.4375	125.3189	125.1097	124.1354	124.1354	123.9550	124.5107	125.1097	125.5330	125.9757 (39)
Average = Sum(39)m / 12 =												125.3179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2591	1.2567	1.2543	1.2432	1.2412	1.2315	1.2315	1.2297	1.2352	1.2412	1.2454	1.2498 (40)
HLP (average)												1.2432 (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												

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	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	23.6834	21.0354	17.1071	12.9512	9.6812	8.1733	8.8315	11.4795	15.4078	19.5637	22.8337	24.3417	(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	391.8297	390.3870	376.6738	354.0324	329.9687	307.6578	293.7293	297.8300	309.9606	332.7472	358.9638	379.6595	(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				1.3000	10.6334	0.4500	0.0000	0.7700	4.7898 (74)			
East				4.7000	19.6403	0.4500	0.0000	0.7700	31.9851 (76)			
South				8.3500	46.7521	0.4500	0.0000	0.7700	135.2666 (78)			
West				2.8000	19.6403	0.4500	0.0000	0.7700	19.0550 (80)			
Solar gains	191.0965	330.5307	462.1774	583.7353	659.9090	656.7332	632.5759	576.2151	504.7243	368.3139	229.8869	162.8487 (83)
Total gains	582.9263	720.9177	838.8512	937.7677	989.8777	964.3910	926.3052	874.0450	814.6850	701.0610	588.8508	542.5082 (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	63.5414	63.6632	63.7832	64.3525	64.4601	64.9660	64.9660	65.0606	64.7702	64.4601	64.2427	64.0170	
alpha	5.2361	5.2442	5.2522	5.2902	5.2973	5.3311	5.3311	5.3374	5.3180	5.2973	5.2828	5.2678	
util living area	0.9992	0.9972	0.9910	0.9684	0.9007	0.7507	0.5746	0.6275	0.8632	0.9822	0.9979	0.9994	(86)
MIT	19.7439	19.9204	20.1805	20.5017	20.7772	20.9422	20.9886	20.9822	20.8721	20.4980	20.0521	19.7116	(87)
Th 2	19.8730	19.8749	19.8768	19.8856	19.8872	19.8949	19.8949	19.8963	19.8919	19.8872	19.8839	19.8804	(88)
util rest of house	0.9988	0.9961	0.9872	0.9541	0.8552	0.6507	0.4384	0.4899	0.7863	0.9715	0.9968	0.9992	(89)
MIT 2	18.7336	18.9112	19.1708	19.4907	19.7415	19.8705	19.8925	19.8920	19.8258	19.4931	19.0503	18.7074	(90)
Living area fraction	18.9040	19.0814	19.3411	19.6612	19.9162	20.0512	20.0773	20.0759	20.0023	19.6626	19.2192	18.8767	(91)
Temperature adjustment	18.9040	19.0814	19.3411	19.6612	19.9162	20.0512	20.0773	20.0759	20.0023	19.6626	19.2192	18.8767	(92)
adjusted MIT	18.9040	19.0814	19.3411	19.6612	19.9162	20.0512	20.0773	20.0759	20.0023	19.6626	19.2192	18.8767	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9984	0.9950	0.9847	0.9504	0.8566	0.6663	0.4617	0.5135	0.7954	0.9686	0.9959	0.9989	(94)
Ext temp.	581.9900	717.3112	826.0075	891.2332	847.9577	642.5262	427.6941	448.7910	647.9679	679.0319	586.4475	541.9076	(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	1853.5159	1796.4354	1623.5932	1348.5791	1027.9260	676.6886	431.6596	455.6418	734.8971	1133.8201	1521.3648	1848.9101	(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	946.0153	725.1714	593.4038	329.2891	133.8964	0.0000	0.0000	0.0000	0.0000	338.3624	673.1405	972.4099	(98)
												4711.6888	(98)
												46.7429	(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	1166.8730	918.6022	942.0581	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8643	0.9280	0.9072	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1008.5385	852.4694	854.6097	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1233.0129	1186.2375	1127.1172	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	161.6216	248.3234	202.7456	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												612.6906 (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	40.4054	62.0809	50.6864	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												153.1726 (107)
Space cooling per m2												1.5196 (108)
Energy for space heating												46.7429 (99)
Energy for space cooling												1.5196 (108)
Total												48.2625 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.3 (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)			17.1500	1.3258	22.7367		(27)					
ground			50.4000	0.1300	6.5520		(28a)					
external	145.4400	19.1500	126.2900	0.1800	22.7322		(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) =		60.5729		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8020 (36)					
Total fabric heat loss						(33) + (36) =	71.3749 (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	121.5477	121.2302	120.9189	119.4571	119.1836	117.9103	117.9103	117.6746	118.4008	119.1836	119.7369	120.3153 (39)
Average = Sum(39)m / 12 =												119.4558 (39)
HLP	Jan 1.2058	Feb 1.2027	Mar 1.1996	Apr 1.1851	May 1.1824	Jun 1.1697	Jul 1.1697	Aug 1.1674	Sep 1.1746	Oct 1.1824	Nov 1.1879	Dec 1.1936 (40)
HLP (average)												1.1851 (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											
	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	23.6834	21.0354	17.1071	12.9512	9.6812	8.1733	8.8315	11.4795	15.4078	19.5637	22.8337	24.3417	(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	391.8297	390.3870	376.6738	354.0324	329.9687	307.6578	293.7293	297.8300	309.9606	332.7472	358.9638	379.6595	(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					1.3000	10.6334	0.6300		0.7000		0.7700		4.2246 (74)
East					4.7000	19.6403	0.6300		0.7000		0.7700		28.2109 (76)
South					8.3500	46.7521	0.6300		0.7000		0.7700		119.3051 (78)
West					2.8000	19.6403	0.6300		0.7000		0.7700		16.8065 (80)
Solar gains	168.5471	291.5281	407.6405	514.8545	582.0397	579.2387	557.9319	508.2217	445.1669	324.8528	202.7603	143.6326	(83)
Total gains	560.3769	681.9151	784.3143	868.8870	912.0084	886.8965	851.6612	806.0517	755.1275	657.6000	561.7241	523.2921	(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	57.5906	57.7414	57.8900	58.5985	58.7329	59.3671	59.3671	59.4861	59.1212	58.7329	58.4615	58.1804	
alpha	4.8394	4.8494	4.8593	4.9066	4.9155	4.9578	4.9578	4.9657	4.9414	4.9155	4.8974	4.8787	
util living area	0.9986	0.9960	0.9888	0.9655	0.9008	0.7587	0.5877	0.6379	0.8627	0.9787	0.9968	0.9990	(86)
MIT	19.6439	19.8256	20.0971	20.4385	20.7343	20.9241	20.9830	20.9748	20.8464	20.4480	19.9780	19.6148	(87)
Th 2	19.9153	19.9179	19.9203	19.9319	19.9341	19.9443	19.9443	19.9462	19.9404	19.9341	19.9297	19.9251	(88)
util rest of house	0.9981	0.9946	0.9847	0.9517	0.8599	0.6671	0.4575	0.5080	0.7931	0.9677	0.9954	0.9986	(89)
MIT 2	18.6806	18.8636	19.1350	19.4775	19.7515	19.9085	19.9399	19.9389	19.8545	19.4931	19.0256	18.6593	(90)
Living area fraction									fLA = Living area / (4) =			0.1687	(91)
MIT	18.8431	19.0259	19.2973	19.6396	19.9173	20.0798	20.1158	20.1136	20.0218	19.6542	19.1862	18.8204	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8431	19.0259	19.2973	19.6396	19.9173	20.0798	20.1158	20.1136	20.0218	19.6542	19.1862	18.8204	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9930	0.9815	0.9470	0.8591	0.6800	0.4796	0.5300	0.7994	0.9638	0.9940	0.9981	(94)
Ext temp.	558.9013	677.1736	769.8082	822.8364	783.5293	603.1273	408.4762	427.1734	603.6618	633.8212	558.3746	522.2991	(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	1767.6771	1712.4807	1547.4355	1282.9165	979.3624	646.1226	414.5527	436.9978	701.1412	1079.1090	1447.1698	1759.0636	(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	899.3292	695.7263	578.5547	331.2577	145.6998	0.0000	0.0000	0.0000	0.0000	331.2941	639.9325	920.1528	(98)
Space heating per m2												4541.9472	(98)
												(98) / (4) =	45.0590 (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	1108.3573	872.5366	894.3267	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8445	0.9121	0.8908	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	936.0042	795.8760	796.6790	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1142.4350	1098.9913	1047.6445	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	148.6302	225.5178	186.7183	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												560.8662 (104)
Cooled fraction												1.0000 (105)
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	0.0000	37.1575	56.3794	46.6796	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												140.2166 (107)
Space cooling per m2												1.3910 (108)
Energy for space heating												45.0590 (99)
Energy for space cooling												1.3910 (108)
Total												46.4500 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												3.9800
Infiltration rate												0.1990 (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) =	0.1692 (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												
	0.1988	0.1861	0.1861	0.1692	0.1734	0.1649	0.1649	0.1607	0.1607	0.1734	0.1692	0.1734 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =		70.4270		(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) = 29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss						(33) + (36) =	78.6660 (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	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618 (39)
Average = Sum(39)m / 12 =												120.6618 (39)
HLP	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970 (40)
HLP (average)												1.1970 (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	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)

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	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)
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												
Total per year (kWh/year) = Sum(64)m =												1730 (64)

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	59.2085	52.5885	42.7678	32.3780	24.2029	20.4331	22.0787	28.6988	38.5194	48.9093	57.0843	60.8541 (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	633.1173	628.1860	603.5324	565.2389	525.8229	490.7170	470.3507	479.4507	501.6272	540.1480	582.9351	615.5062 (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				1.3000	13.4684	0.4500		0.0000		0.7700		6.0668 (74)
East				4.7000	25.1733	0.4500		0.0000		0.7700		40.9959 (76)
South				8.3500	56.5862	0.4500		0.0000		0.7700		163.7195 (78)
West				2.8000	25.1733	0.4500		0.0000		0.7700		24.4231 (80)

Solar gains	235.2053	346.2398	493.5390	628.2442	671.3353	740.9504	685.0248	648.5209	564.9218	416.4247	282.0036	189.7643 (83)
Total gains	868.3226	974.4258	1097.0714	1193.4831	1197.1582	1231.6675	1155.3756	1127.9716	1066.5490	956.5727	864.9387	805.2705 (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	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362
Feb	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557
util living area	0.9915	0.9840	0.9578	0.8830	0.7355	0.4939	0.3440	0.3417	0.6132	0.8895	0.9781	0.9939 (86)
MIT	20.1769	20.2975	20.5328	20.7843	20.9400	20.9942	20.9994	20.9994	20.9821	20.8160	20.4634	20.1368 (87)
Th 2	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224 (88)
util rest of house	0.9882	0.9778	0.9419	0.8421	0.6571	0.3926	0.2320	0.2270	0.5051	0.8394	0.9680	0.9914 (89)
MIT 2	19.2042	19.3222	19.5481	19.7737	19.8922	19.9209	19.9223	19.9223	19.9166	19.8060	19.4858	19.1648 (90)
Living area fraction									fLA = Living area / (4) =			0.1687 (91)
MIT	19.3683	19.4867	19.7141	19.9441	20.0689	20.1019	20.1040	20.1040	20.0963	19.9764	19.6507	19.3288 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2183	19.3367	19.5641	19.7941	19.9189	19.9519	19.9540	19.9540	19.9463	19.8264	19.5007	19.1788 (93)

8. Space heating requirement

Utilisation	0.9852	0.9734	0.9353	0.8365	0.6568	0.3954	0.2353	0.2304	0.5076	0.8340	0.9627	0.9890 (94)
Useful gains	855.4977	948.5137	1026.1084	998.3167	786.2799	486.9941	271.8884	259.8351	541.3849	797.8053	832.6989	796.3935 (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	1643.2040	1609.2323	1443.6146	1169.7130	822.7783	488.9060	271.9661	259.9016	548.5659	932.2782	1315.2962	1626.3728 (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	586.0535	444.0029	310.6246	123.4054	27.1548	0.0000	0.0000	0.0000	0.0000	100.0478	347.4701	617.5046 (98)
Space heating												2556.2636 (98)
RHI space heating demand												2556 (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												3.9800
Infiltration rate												0.1990 (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) =	0.1692 (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												
	0.2157	0.2114	0.2072	0.1861	0.1818	0.1607	0.1607	0.1565	0.1692	0.1818	0.1903	0.1988 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =	70.4270			(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) = 29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss						(33) + (36) =	78.6660 (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	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618 (39)
Average = Sum(39)m / 12 =												120.6618 (39)
HLP	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970 (40)
HLP (average)												1.1970 (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												
	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)
										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												
	59.2085	52.5885	42.7678	32.3780	24.2029	20.4331	22.0787	28.6988	38.5194	48.9093	57.0843	60.8541 (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												
	633.1173	628.1860	603.5324	565.2389	525.8229	490.7170	470.3507	479.4507	501.6272	540.1480	582.9351	615.5062 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access		Gains
North				1.3000	10.6334	0.4500		0.0000		0.7700		4.7898 (74)
East				4.7000	19.6403	0.4500		0.0000		0.7700		31.9851 (76)
South				8.3500	46.7521	0.4500		0.0000		0.7700		135.2666 (78)
West				2.8000	19.6403	0.4500		0.0000		0.7700		19.0550 (80)
Solar gains	191.0965	330.5307	462.1774	583.7353	659.9090	656.7332	632.5759	576.2151	504.7243	368.3139	229.8869	162.8487 (83)
Total gains	824.2138	958.7167	1065.7099	1148.9742	1185.7319	1147.4502	1102.9266	1055.6658	1006.3516	908.4619	812.8220	778.3550 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362
alpha	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557
util living area												
	0.9955	0.9891	0.9727	0.9267	0.8209	0.6455	0.4767	0.5182	0.7554	0.9459	0.9900	0.9967 (86)
MIT	20.0140	20.1793	20.4115	20.6738	20.8772	20.9740	20.9958	20.9934	20.9402	20.6735	20.2798	19.9671 (87)
Th 2	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224 (88)
util rest of house												
	0.9938	0.9852	0.9626	0.8997	0.7612	0.5490	0.3625	0.4009	0.6652	0.9199	0.9856	0.9954 (89)
MIT 2	19.0426	19.2058	19.4323	19.6779	19.8484	19.9123	19.9215	19.9209	19.8950	19.6837	19.3066	18.9960 (90)
Living area fraction												
MIT	19.2064	19.3700	19.5975	19.8459	20.0219	20.0913	20.1027	20.1018	20.0713	19.8506	19.4707	19.1598 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0564	19.2200	19.4475	19.6959	19.8719	19.9413	19.9527	19.9518	19.9213	19.7006	19.3207	19.0098 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9919	0.9817	0.9569	0.8929	0.7580	0.5508	0.3658	0.4042	0.6651	0.9130	0.9822	0.9939 (94)
Useful gains	817.5441	941.1662	1019.7929	1025.9147	898.7963	632.0541	403.4638	426.6967	669.3331	829.4594	798.3621	773.6167 (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												
	1780.5339	1727.8763	1562.2675	1302.6472	986.0385	644.4961	404.5421	428.5636	702.4105	1098.0951	1474.5748	1786.9777 (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												
	716.4644	528.6692	403.6011	199.2474	64.9082	0.0000	0.0000	0.0000	0.0000	199.8650	486.8732	753.9406 (98)
Space heating												3353.5691 (98)
Space heating per m ²												(98) / (4) = 33.2695 (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												3705.6012	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	716.4644	528.6692	403.6011	199.2474	64.9082	0.0000	0.0000	0.0000	0.0000	199.8650	486.8732	753.9406	(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)	791.6734	584.1649	445.9681	220.1629	71.7218	0.0000	0.0000	0.0000	0.0000	220.8453	537.9814	833.0835	(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													
Efficiency of water heater (217)m	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)
Fuel for water heating, kWh/month	89.8495	89.7555	89.5659	89.1445	88.3063	87.3000	87.3000	87.3000	87.3000	89.1178	89.6933	89.8902	(216)
Water heating fuel used	196.2770	172.2835	179.2012	158.4418	154.5713	136.5609	128.1706	144.7655	145.8103	164.4979	176.5110	190.4805	(219)
Annual totals kWh/year												1947.5715	(219)
Space heating fuel - main system												3705.6012	(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)												418.2565	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 597 * 1.00) =										-573.4671		-573.4671	(233)
Total delivered energy for all uses												5640.1675	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3705.6012	3.4800	128.9549 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1947.5715	3.4800	67.7755 (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	418.2565	13.1900	55.1680 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-573.4671	13.1900	-75.6403 (252)
Total energy cost			315.0150 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9075 (257)
SAP value		87.3411
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3705.6012	0.2160	800.4099 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1947.5715	0.2160	420.6754 (264)
Space and water heating			1221.0853 (265)
Pumps and fans	142.2054	0.5190	73.8046 (267)
Energy for lighting	418.2565	0.5190	217.0751 (268)
Energy saving/generation technologies			
PV Unit	-573.4671	0.5190	-297.6294 (269)
Total kg/year			1214.3356 (272)
CO2 emissions per m2			12.0500 (273)
EI value			88.8394
EI rating			89 (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	$3.48 / 0.8871 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8871 = 0.2435$, 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												3.9800
Infiltration rate												0.1990 (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) =	0.1692 (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												
	0.1988	0.1861	0.1861	0.1692	0.1734	0.1649	0.1649	0.1607	0.1607	0.1734	0.1692	0.1734 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =	70.4270			(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) = 29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss							(33) + (36) = 78.6660 (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	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618 (39)
Average = Sum(39)m / 12 =												120.6618 (39)
HLP	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970 (40)
HLP (average)												1.1970 (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)
										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												
	59.2085	52.5885	42.7678	32.3780	24.2029	20.4331	22.0787	28.6988	38.5194	48.9093	57.0843	60.8541 (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												
	633.1173	628.1860	603.5324	565.2389	525.8229	490.7170	470.3507	479.4507	501.6272	540.1480	582.9351	615.5062 (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				1.3000	13.4684	0.4500		0.0000		0.7700	6.0668 (74)	
East				4.7000	25.1733	0.4500		0.0000		0.7700	40.9959 (76)	
South				8.3500	56.5862	0.4500		0.0000		0.7700	163.7195 (78)	
West				2.8000	25.1733	0.4500		0.0000		0.7700	24.4231 (80)	

Solar gains	235.2053	346.2398	493.5390	628.2442	671.3353	740.9504	685.0248	648.5209	564.9218	416.4247	282.0036	189.7643 (83)
Total gains	868.3226	974.4258	1097.0714	1193.4831	1197.1582	1231.6675	1155.3756	1127.9716	1066.5490	956.5727	864.9387	805.2705 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362
alpha	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557
util living area												
	0.9915	0.9840	0.9578	0.8830	0.7355	0.4939	0.3440	0.3417	0.6132	0.8895	0.9781	0.9939 (86)
MIT	20.1769	20.2975	20.5328	20.7843	20.9400	20.9942	20.9994	20.9994	20.9821	20.8160	20.4634	20.1368 (87)
Th 2	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224 (88)
util rest of house												
	0.9882	0.9778	0.9419	0.8421	0.6571	0.3926	0.2320	0.2270	0.5051	0.8394	0.9680	0.9914 (89)
MIT 2	19.2042	19.3222	19.5481	19.7737	19.8922	19.9209	19.9223	19.9223	19.9166	19.8060	19.4858	19.1648 (90)
Living area fraction												
MIT	19.3683	19.4867	19.7141	19.9441	20.0689	20.1019	20.1040	20.1040	20.0963	19.9764	19.6507	19.3288 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2183	19.3367	19.5641	19.7941	19.9189	19.9519	19.9540	19.9540	19.9463	19.8264	19.5007	19.1788 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9852	0.9734	0.9353	0.8365	0.6568	0.3954	0.2353	0.2304	0.5076	0.8340	0.9627	0.9890 (94)
Useful gains	855.4977	948.5137	1026.1084	998.3167	786.2799	486.9941	271.8884	259.8351	541.3849	797.8053	832.6989	796.3935 (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												
	1643.2040	1609.2323	1443.6146	1169.7130	822.7783	488.9060	271.9661	259.9016	548.5659	932.2782	1315.2962	1626.3728 (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												
	586.0535	444.0029	310.6246	123.4054	27.1548	0.0000	0.0000	0.0000	0.0000	100.0478	347.4701	617.5046 (98)
Space heating												2556.2636 (98)
Space heating per m ²										(98) / (4) =		25.3598 (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													2824.6007 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	586.0535	444.0029	310.6246	123.4054	27.1548	0.0000	0.0000	0.0000	0.0000	100.0478	347.4701	617.5046	(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)	647.5729	490.6109	343.2316	136.3595	30.0053	0.0000	0.0000	0.0000	0.0000	110.5501	383.9448	682.3255	(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	89.7391	89.6511	89.3838	88.7635	87.8152	87.3000	87.3000	87.3000	87.3000	88.5704	89.4734	89.7855	(216)
Fuel for water heating, kWh/month	196.5183	172.4840	179.5662	159.1218	155.4356	136.5609	128.1706	144.7655	145.8103	165.5147	176.9447	190.7026	(219)
Water heating fuel used												1951.5952	(219)
Annual totals kWh/year													
Space heating fuel - main system												2824.6007	(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)												418.2565	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 696 * 1.00) =										-668.4685		-668.4685	(233)
Total delivered energy for all uses												4668.1893	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2824.6007	10.2300	288.9566 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1951.5952	10.2300	199.6482 (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	418.2565	36.7200	153.5838 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.4685	36.7200	-245.4616 (252)
Total energy cost			551.9448 (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	2824.6007	0.2160	610.1137 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1951.5952	0.2160	421.5446 (264)
Space and water heating			1031.6583 (265)
Pumps and fans	142.2054	0.5190	73.8046 (267)
Energy for lighting	418.2565	0.5190	217.0751 (268)
Energy saving/generation technologies			
PV Unit	-668.4685	0.5190	-346.9352 (269)
Total kg/year			975.6029 (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	2824.6007	1.2200	3446.0128 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1951.5952	1.2200	2380.9462 (264)
Space and water heating			5826.9590 (265)
Pumps and fans	142.2054	3.0700	436.5705 (267)
Energy for lighting	418.2565	3.0700	1284.0475 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-668.4685	3.0700	-2052.1983 (269)
Primary energy kWh/year			5495.3788 (272)
Primary energy kWh/m2/year			54.5176 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

(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 (19.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£86 1.92 kg/m²	B 88	B 91
Total Savings	£86 1.92 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	B 91

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

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

	Current	Potential	Saving
Electricity	£206	£224	-£18
Mains gas	£592	£488	£104
Space heating	£444	£444	£0
Water heating	£200	£114	£86
Lighting	£154	£154	£0
Generated (PV)	-£245	-£245	£0
Total cost of fuels	£553	£467	£86
Total cost of uses	£553	£467	£86
Delivered energy	46 kWh/m²	37 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	44 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												3.9800
Infiltration rate												0.1990 (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) =	0.1692 (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												
	0.2157	0.2114	0.2072	0.1861	0.1818	0.1607	0.1607	0.1565	0.1692	0.1818	0.1903	0.1988 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =	70.4270			(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) = 29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss						(33) + (36) =	78.6660 (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	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618 (39)
Average = Sum(39)m / 12 =												120.6618 (39)
HLP	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970 (40)
HLP (average)												1.1970 (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	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)

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										Total = Sum (45)m =		1564.5268 (45)
Water storage loss:	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)
Total storage loss:												
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi loss	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	59.2085	52.5885	42.7678	32.3780	24.2029	20.4331	22.0787	28.6988	38.5194	48.9093	57.0843	60.8541	(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	633.1173	628.1860	603.5324	565.2389	525.8229	490.7170	470.3507	479.4507	501.6272	540.1480	582.9351	615.5062	(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			1.3000		10.6334		0.4500		0.0000		0.7700		4.7898 (74)
East			4.7000		19.6403		0.4500		0.0000		0.7700		31.9851 (76)
South			8.3500		46.7521		0.4500		0.0000		0.7700		135.2666 (78)
West			2.8000		19.6403		0.4500		0.0000		0.7700		19.0550 (80)
Solar gains	191.0965	330.5307	462.1774	583.7353	659.9090	656.7332	632.5759	576.2151	504.7243	368.3139	229.8869		162.8487 (83)
Total gains	824.2138	958.7167	1065.7099	1148.9742	1185.7319	1147.4502	1102.9266	1055.6658	1006.3516	908.4619	812.8220		778.3550 (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	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	
alpha	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	
util living area	0.9955	0.9891	0.9727	0.9267	0.8209	0.6455	0.4767	0.5182	0.7554	0.9459	0.9900	0.9967	(86)
MIT	20.0140	20.1793	20.4115	20.6738	20.8772	20.9740	20.9958	20.9934	20.9402	20.6735	20.2798	19.9671	(87)
Th 2	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	(88)
util rest of house	0.9938	0.9852	0.9626	0.8997	0.7612	0.5490	0.3625	0.4009	0.6652	0.9199	0.9856	0.9954	(89)
MIT 2	19.0426	19.2058	19.4323	19.6779	19.8484	19.9123	19.9215	19.9209	19.8950	19.6837	19.3066	18.9960	(90)
Living area fraction	19.2064	19.3700	19.5975	19.8459	20.0219	20.0913	20.1027	20.1018	20.0713	19.8506	19.4707	19.1598	(91)
MIT													(92)
Temperature adjustment													(93)
adjusted MIT	19.0564	19.2200	19.4475	19.6959	19.8719	19.9413	19.9527	19.9518	19.9213	19.7006	19.3207	19.0098	(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	0.9919	0.9817	0.9569	0.8929	0.7580	0.5508	0.3658	0.4042	0.6651	0.9130	0.9822	0.9939	(94)
Useful gains	817.5441	941.1662	1019.7929	1025.9147	898.7963	632.0541	403.4638	426.6967	669.3331	829.4594	798.3621	773.6167	(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	1780.5339	1727.8763	1562.2675	1302.6472	986.0385	644.4961	404.5421	428.5636	702.4105	1098.0951	1474.5748	1786.9777	(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	716.4644	528.6692	403.6011	199.2474	64.9082	0.0000	0.0000	0.0000	0.0000	199.8650	486.8732	753.9406	(98)
Space heating												3353.5691	(98)
Space heating per m2												(98) / (4) =	33.2695 (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													3705.6012 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	716.4644	528.6692	403.6011	199.2474	64.9082	0.0000	0.0000	0.0000	0.0000	199.8650	486.8732	753.9406	(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)	791.6734	584.1649	445.9681	220.1629	71.7218	0.0000	0.0000	0.0000	0.0000	220.8453	537.9814	833.0835	(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	89.9258	89.9215	89.9055	89.8909	89.7908	87.3000	87.3000	87.3000	87.3000	89.4602	89.8130	89.9525	(216)
(217)m	89.9258	89.9215	89.9055	89.8909	89.7908	87.3000	87.3000	87.3000	87.3000	89.4602	89.8130	89.9525	(217)
Fuel for water heating, kWh/month	168.0661	125.1654	98.8041	50.2682	19.8544	2.9180	0.0000	29.5441	55.5689	103.7321	142.9694	166.8873	(219)
Water heating fuel used												963.7779	(219)
Annual totals kWh/year													
Space heating fuel - main system												3705.6012	(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)													418.2565 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 597 * 1.00) =										-573.4671		-573.4671	(233)
Total delivered energy for all uses												4706.3739	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3705.6012	3.4800	128.9549	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	963.7779	3.4800	33.5395	(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	418.2565	13.1900	55.1680	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-573.4671	13.1900	-75.6403	(252)
Total energy cost			287.3740	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8278 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.4518
SAP rating (Section 12)		88 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3705.6012	0.2160	800.4099 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	963.7779	0.2160	208.1760 (264)
Space and water heating			1008.5859 (265)
Pumps and fans	192.2054	0.5190	99.7546 (267)
Energy for lighting	418.2565	0.5190	217.0751 (268)
Energy saving/generation technologies			
PV Unit	-573.4671	0.5190	-297.6294 (269)
Total kg/year			1027.7862 (272)
CO2 emissions per m2			10.2000 (273)
EI value			90.5540
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											3.9800	
Infiltration rate											0.1990 (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) =	0.1692 (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												
	0.1988	0.1861	0.1861	0.1692	0.1734	0.1649	0.1649	0.1607	0.1607	0.1734	0.1692	0.1734 (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)			17.1500	1.3258	22.7367		(27)
ground			50.4000	0.1200	6.0480	75.0000	3780.0001 (28a)
external	145.4400	19.1500	126.2900	0.2700	34.0983	150.0000	18943.5004 (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) =	70.4270			(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) = 29032.5006 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							288.0208 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2390 (36)
Total fabric heat loss						(33) + (36) =	78.6660 (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	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618	120.6618 (39)
Average = Sum(39)m / 12 =												120.6618 (39)
HLP	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970	1.1970 (40)
HLP (average)												1.1970 (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										Total = Sum (45)m =		1564.5268 (45)
Water storage loss:	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)
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	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	59.2085	52.5885	42.7678	32.3780	24.2029	20.4331	22.0787	28.6988	38.5194	48.9093	57.0843	60.8541	(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	633.1173	628.1860	603.5324	565.2389	525.8229	490.7170	470.3507	479.4507	501.6272	540.1480	582.9351	615.5062	(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				1.3000	13.4684	0.4500		0.0000		0.7700	6.0668 (74)	
East				4.7000	25.1733	0.4500		0.0000		0.7700	40.9959 (76)	
South				8.3500	56.5862	0.4500		0.0000		0.7700	163.7195 (78)	
West				2.8000	25.1733	0.4500		0.0000		0.7700	24.4231 (80)	
Solar gains	235.2053	346.2398	493.5390	628.2442	671.3353	740.9504	685.0248	648.5209	564.9218	416.4247	282.0036	189.7643 (83)
Total gains	868.3226	974.4258	1097.0714	1193.4831	1197.1582	1231.6675	1155.3756	1127.9716	1066.5490	956.5727	864.9387	805.2705 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	66.8362	
alpha	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	5.4557	
util living area	0.9915	0.9840	0.9578	0.8830	0.7355	0.4939	0.3440	0.3417	0.6132	0.8895	0.9781	0.9939	(86)
MIT	20.1769	20.2975	20.5328	20.7843	20.9400	20.9942	20.9994	20.9994	20.9821	20.8160	20.4634	20.1368	(87)
Th 2	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	19.9224	(88)
util rest of house	0.9882	0.9778	0.9419	0.8421	0.6571	0.3926	0.2320	0.2270	0.5051	0.8394	0.9680	0.9914	(89)
MIT 2	19.2042	19.3222	19.5481	19.7737	19.8922	19.9209	19.9223	19.9223	19.9166	19.8060	19.4858	19.1648	(90)
Living area fraction	19.3683	19.4867	19.7141	19.9441	20.0689	20.1019	20.1040	20.1040	20.0963	19.9764	19.6507	19.3288	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2183	19.3367	19.5641	19.7941	19.9189	19.9519	19.9540	19.9540	19.9463	19.8264	19.5007	19.1788	(93)

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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	0.9852	0.9734	0.9353	0.8365	0.6568	0.3954	0.2353	0.2304	0.5076	0.8340	0.9627	0.9890	(94)
Useful gains	855.4977	948.5137	1026.1084	998.3167	786.2799	486.9941	271.8884	259.8351	541.3849	797.8053	832.6989	796.3935	(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	1643.2040	1609.2323	1443.6146	1169.7130	822.7783	488.9060	271.9661	259.9016	548.5659	932.2782	1315.2962	1626.3728	(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	586.0535	444.0029	310.6246	123.4054	27.1548	0.0000	0.0000	0.0000	0.0000	100.0478	347.4701	617.5046	(98)
Space heating												2556.2636	(98)
Space heating per m2											(98) / (4) =	25.3598	(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													2824.6007	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	586.0535	444.0029	310.6246	123.4054	27.1548	0.0000	0.0000	0.0000	0.0000	100.0478	347.4701	617.5046	(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)	647.5729	490.6109	343.2316	136.3595	30.0053	0.0000	0.0000	0.0000	0.0000	110.5501	383.9448	682.3255	(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	89.8402	89.8336	89.7756	89.6468	89.0159	87.3000	87.3000	87.3000	87.3000	88.9677	89.6388	89.8637	(216)	
(217)m	89.8402	89.8336	89.7756	89.6468	89.0159	87.3000	87.3000	87.3000	87.3000	88.9677	89.6388	89.8637	(217)	
Fuel for water heating, kWh/month	163.4481	125.4152	97.6614	48.2757	25.4502	0.0000	0.0000	22.1272	49.8217	99.6752	137.6778	164.5331	(219)	
Water heating fuel used												934.0858	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2824.6007	(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)													418.2565	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 696 * 1.00) =													-668.4685	(233)
Total delivered energy for all uses													3700.6799	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2824.6007	10.2300	288.9566	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	934.0858	10.2300	95.5570	(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	418.2565	36.7200	153.5838	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.4685	36.7200	-245.4616	(252)
Total energy cost			466.2136	(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	2824.6007	0.2160	610.1137	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	934.0858	0.2160	201.7625	(264)
Space and water heating			811.8763	(265)

FULL SAP CALCULATION PRINTOUT

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Pumps and fans	192.2054	0.5190	99.7546 (267)
Energy for lighting	418.2565	0.5190	217.0751 (268)
Energy saving/generation technologies			
PV Unit	-668.4685	0.5190	-346.9352 (269)
Total kg/year			781.7709 (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	2824.6007	1.2200	3446.0128 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	934.0858	1.2200	1139.5847 (264)
Space and water heating			4585.5975 (265)
Pumps and fans	192.2054	3.0700	590.0705 (267)
Energy for lighting	418.2565	3.0700	1284.0475 (268)
Energy saving/generation technologies			
PV Unit	-668.4685	3.0700	-2052.1983 (269)
Primary energy kWh/year			4407.5173 (272)
Primary energy kWh/m2/year			43.7254 (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	288.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	335.97 (P1)
Transmission heat loss coefficient	78.67 (P7)
Summer heat loss coefficient	414.63 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.3000	87.1704	0.4500	0.0000	0.9000	45.8952
East	4.7000	125.2818	0.4500	0.0000	0.9000	238.4739
South	8.3500	118.5567	0.4500	0.0000	0.9000	400.9290
West	2.8000	125.2818	0.4500	0.0000	0.9000	142.0695
total:						827.3677

Solar gains	Jun 881	Jul 827	Aug 766	(P4)
Internal gains	488	467	476	
Total summer gains	1369	1295	1243	(P5)
Summer gain/loss ratio	3.30	3.12	3.00	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 288.0)	0.00	0.00	0.00	
Threshold temperature	18.70	20.42	20.30	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 76	Issued on Date	03/11/2023
Assessment Reference	plot 76 way	Prop Type Ref	21809
Property	12 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	13.97
Environmental	89 B	TER	17.47
CO ₂ Emissions (t/year)	0.98	% DER<TER	20.04
General Requirements Compliance	Pass	DFEE	48.26
		TFEE	53.42
		% DFEE<TFEE	9.65
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.47	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.97	kgCO ₂ /m ²	Pass
	-3.50 (-20.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.42	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.26	kWh/m ² /yr	
	-5.1 (-9.6%)	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	1.36 (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	3.98 (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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Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

1.30 m², No overhang

Windows facing East

4.70 m², No overhang

Windows facing South

8.35 m², No overhang

Windows facing West

2.80 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

3.98 (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

0.033

W/m²K

Air permeability

4.0

m³/m²h

Photovoltaic array

1.20

kW

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

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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		
		1st Storey:		1.00 m		50.40 m ²		
						2.45 m		
						2.60 m		
7.0 Living Area	17.00					m ²		
8.0 Thermal Mass Parameter	Precise calculation							
Thermal Mass	288.02					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	126.29
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

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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					1.30	
side	Window	[1] external	West	None	0.00					2.80	
side	Window	[1] external	East	None	0.00					4.70	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	14.00	0.300	No
Independently assessed	E3 Sill	10.70	0.015	No
Independently assessed	E4 Jamb	31.50	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 0.033 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.01	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	3.98	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

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Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500229
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

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

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	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	

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25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.20	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 88	