

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	Flat 8			Issued on Date	21/06/2023
Assessment Reference	001	Prop Type Ref	8		
Property	Birchwood House, Flat 8, Northwood, HA6 2UZ				
SAP Rating	85 B	DER	8.14	TER	18.56
Environmental	93 A	% DER<TER	56.14		
CO ₂ Emissions (t/year)	0.93	DFEE	34.62	TFEE	39.32
General Requirements Compliance	Pass	% DFEE<TFEE	11.95		
Assessor Details	Mr. Zahid Ashraf, Wires & Wireless Ltd, Tel: 01793 273 981, zahid_153@yahoo.com			Assessor ID	Q076-0001
Client	Westcombe Group, Birchwood House				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 145 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:Electricity (c)

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 18.56 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.14 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)39.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)34.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Floor (no floor)			
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.40 (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:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 0.50 kWh/day

Permitted by DBSCG 0.50 OK

Primary pipework insulated: No primary pipework

6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North: 10.54 m², No overhang

Windows facing West: 5.50 m², No overhang

Air change rate: 0.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Photovoltaic array 1.32 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (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					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					5.0000
Infiltration rate					0.2500 (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) =				0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												64.4000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.4489	0.4436	0.4383	0.4118	0.4064	0.3799	0.3799	0.3746	0.3905	0.4064	0.4171	0.4277 (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
N Window (Uw = 1.40)			16.0400	1.3258	21.2652		(27)
External Wall -Type 4	78.5600	16.0400	62.5200	0.1900	11.8788		(29a)
Roof Joist	32.4900		32.4900	0.1500	4.8735		(30)
Total net area of external elements Aum(A, m ²)			111.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0175		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0617 (36)
Total fabric heat loss							(33) + (36) = 48.0792 (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	57.6302	56.9483	56.2663	52.8565	52.1745	48.7647	48.7647	48.0827	50.1286	52.1745	53.5384	54.9024 (38)
Heat transfer coeff	105.7094	105.0275	104.3455	100.9357	100.2537	96.8439	96.8439	96.1619	98.2078	100.2537	101.6176	102.9816 (39)
Average = Sum(39)m / 12 =												100.7652 (39)
HLP	0.7310	0.7263	0.7216	0.6980	0.6933	0.6697	0.6697	0.6650	0.6791	0.6933	0.7027	0.7121 (40)
HLP (average)												0.6968 (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												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.0459	109.8988	105.7517	101.6046	97.4574	93.3103	93.3103	97.4574	101.6046	105.7517	109.8988	114.0459 (44)
Energy content (annual)	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1631.2606 (45)
Water storage loss:	25.3690	22.1879	22.8959	19.9612	19.1533	16.5278	15.3155	17.5747	17.7846	20.7262	22.6243	24.5685 (46)
Store volume												10.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.5000 (48)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b											1.0000 (49)
Enter (49) or (54) in (55)											0.5000 (55)
Total storage loss	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000 (56)
If cylinder contains dedicated solar storage	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408 (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 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408 (64)
Heat gains from water heating, kWh/month	87.2446	77.1922	81.7626	74.2570	73.4664	66.6463	64.9592	69.9672	69.4321	76.9531	80.1602 (65)
Total per year (kWh/year) = Sum(64)m =											2087.6566 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7542	27.3156	22.2146	16.8179	12.5715	10.6134	11.4682	14.9068	20.0078	25.4045	29.6509	31.6090	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.5954	317.8599	309.6334	292.1202	270.0130	249.2353	235.3545	232.0900	240.3164	257.8296	279.9369	300.7146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	(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)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	(71)
Water heating gains (Table 5)	117.2642	114.8693	109.8959	103.1347	98.7451	92.5643	87.3107	94.0419	96.4335	103.4316	111.3336	114.8793	(72)
Total internal gains	529.4947	526.9257	508.6248	478.9537	448.2105	419.2939	401.0143	407.9196	423.6387	453.5467	487.8022	514.0838	(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				10.5400	10.6334	0.5400		0.8000		0.7700			33.5528 (74)
West				5.5000	19.6403	0.5400		0.8000		0.7700			32.3390 (80)

Solar gains	65.8919	127.3832	213.1411	326.9593	421.9745	443.0118	417.1181	342.8375	252.1721	151.3936	81.7147		54.5654 (83)
Total gains	595.3866	654.3089	721.7659	805.9130	870.1851	862.3056	818.1324	750.7571	675.8108	604.9403	569.5170		568.6491 (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	37.9999	38.2466	38.4966	39.7971	40.0678	41.4786	41.4786	41.7727	40.9025	40.0678	39.5300	39.0064
alpha	3.5333	3.5498	3.5664	3.6531	3.6712	3.7652	3.7652	3.7848	3.7268	3.6712	3.6353	3.6004
util living area	0.9857	0.9786	0.9614	0.9129	0.8122	0.6452	0.4984	0.5537	0.7895	0.9382	0.9777	0.9877 (86)
MIT	19.2968	19.4787	19.8116	20.2887	20.6689	20.9060	20.9728	20.9604	20.7873	20.3028	19.7490	19.2983 (87)
Th 2	20.3135	20.3177	20.3218	20.3426	20.3468	20.3677	20.3677	20.3719	20.3593	20.3468	20.3384	20.3301 (88)
util rest of house	0.9837	0.9757	0.9558	0.9001	0.7844	0.5968	0.4339	0.4886	0.7496	0.9267	0.9742	0.9860 (89)
MIT 2	17.9700	18.2374	18.7231	19.4210	19.9506	20.2724	20.3462	20.3390	20.1255	19.4513	18.6458	17.9829 (90)
Living area fraction									fLA = Living area / (4) =			0.1711 (91)
MIT	18.1971	18.4499	18.9094	19.5695	20.0736	20.3808	20.4535	20.4453	20.2388	19.5970	18.8346	18.2080 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1971	18.4499	18.9094	19.5695	20.0736	20.3808	20.4535	20.4453	20.2388	19.5970	18.8346	18.2080 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9751	0.9647	0.9409	0.8821	0.7716	0.5979	0.4429	0.4965	0.7413	0.9101	0.9632	0.9785	(94)	
Useful gains	580.5785	631.2246	679.0743	710.9281	671.4220	515.5752	362.3648	372.7418	500.9662	550.5599	548.5672	556.4144	(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	1469.0539	1423.1073	1294.8653	1076.9326	839.4804	559.8380	373.1862	389.0059	602.8748	901.9860	1192.4442	1442.5654	(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	661.0257	532.1452	458.1485	263.5232	125.0354	0.0000	0.0000	0.0000	0.0000	261.4610	463.5915	659.2964	(98)	
Space heating											3424.2269		(98)	
Space heating per m2											(98) / (4) =		23.6790	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	910.3324	716.6446	730.8304	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8641	0.9141	0.8923	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	786.6251	655.0499	652.1136	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1122.8824	1068.7828	992.4166	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	242.1052	307.8172	253.1854	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												803.1079 (104)
Intermittency factor (Table 10b)												0.5017 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	30.3657	38.6075	31.7554	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												100.7286 (107)
												0.6966 (108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	3424.2269 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3595.4383 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2087.6566 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2192.0394 (310a)
Electricity used for heat distribution	57.8748 (313)
Cooling System Energy Efficiency Ratio	6.7500 (314)
Space cooling (if there is a fixed cooling system, if not enter 0)	14.9228 (315)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1060)	
mechanical ventilation fans (SFP = 1.1060)	524.8867 (330a)
Total electricity for the above, kWh/year	524.8867 (331)
Electricity for lighting (calculated in Appendix L)	543.1291 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 1.32 * 951 * 0.80) =	-803.0804 (333)
Total delivered energy for all uses	6067.3359 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1929.1592	0.5190	1001.2336 (367)
Electrical energy for heat distribution	57.8748	0.5190	30.0370 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1031.2706 (373)
Space and water heating			1031.2706 (376)
Space cooling	14.9228	0.5190	7.7449 (377)
Pumps and fans	524.8867	0.5190	272.4162 (378)
Energy for lighting	543.1291	0.5190	281.8840 (379)
Energy saving/generation technologies			
PV Unit	-803.0804	0.5190	-416.7987 (380)
Total CO2, kg/year			1176.5170 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			8.1400 (384)

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

DER	8.1400 ZC1
Total Floor Area	144.6100
Assumed number of occupants	2.9254
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190
CO2 emissions from appliances, equation (L14)	12.8914 ZC2
CO2 emissions from cooking, equation (L16)	1.3084 ZC3
Total CO2 emissions	22.3398 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	22.3398 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3528 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2999 (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	0.3824	0.3749	0.3674	0.3299	0.3224	0.2849	0.2849	0.2774	0.2999	0.3224	0.3374	0.3524 (22b)
Effective ac	0.5731	0.5703	0.5675	0.5544	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5569	0.5621 (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
TER Opening Type (Uw = 1.40)			16.0400	1.3258	21.2652		(27)
External Wall -Type 4	78.5600	16.0400	62.5200	0.1800	11.2536		(29a)
Roof Joist	32.4900		32.4900	0.1300	4.2237		(30)
Total net area of external elements Aum(A, m ²)			111.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7425		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2118 (36)
Total fabric heat loss						(33) + (36) =	42.9542 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	73.5698	73.2054	72.8482	71.1704	70.8565	69.3952	69.3952	69.1246	69.9581	70.8565	71.4915	72.1554 (38)
Heat transfer coeff	116.5240	116.1596	115.8024	114.1246	113.8107	112.3494	112.3494	112.0788	112.9123	113.8107	114.4457	115.1096 (39)
Average = Sum(39)m / 12 =												114.1231 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8058	0.8033	0.8008	0.7892	0.7870	0.7769	0.7769	0.7750	0.7808	0.7870	0.7914	0.7960 (40)
HLP (average)												0.7892 (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												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.0459	109.8988	105.7517	101.6046	97.4574	93.3103	93.3103	97.4574	101.6046	105.7517	109.8988	114.0459 (44)
Energy conte	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Energy content (annual)										Total = Sum(45)m =		1631.2606 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3690	22.1879	22.8959	19.9612	19.1533	16.5278	15.3155	17.5747	17.7846	20.7262	22.6243	24.5685 (46)
Water storage loss:												
Store volume												10.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.3712 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.2005 (55)
Total storage loss	6.2141	5.6127	6.2141	6.0136	6.2141	6.0136	6.2141	6.2141	6.0136	6.2141	6.0136	6.2141 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	6.2141	5.6127	6.2141	6.0136	6.2141	6.0136	6.2141	6.2141	6.0136	6.2141	6.0136	6.2141 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	198.6033	174.5433	182.1161	161.6005	157.1650	138.7111	131.5795	146.6412	147.0897	167.6515	179.3544	193.2668 (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	198.6033	174.5433	182.1161	161.6005	157.1650	138.7111	131.5795	146.6412	147.0897	167.6515	179.3544	193.2668 (64)
Heat gains from water heating, kWh/month	79.8159	70.4824	74.3339	67.0679	66.0376	59.4572	57.5305	62.5385	62.2431	69.5244	72.9711	78.0415 (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	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.6740	28.1326	22.8790	17.3209	12.9475	10.9309	11.8112	15.3526	20.6062	26.1644	30.5377	32.5544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.5954	317.8599	309.6334	292.1202	270.0130	249.2353	235.3545	232.0900	240.3164	257.8296	279.9369	300.7146 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270 (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)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158 (71)
Water heating gains (Table 5)	107.2794	104.8845	99.9111	93.1499	88.7603	82.5794	77.3259	84.0571	86.4487	93.4467	101.3487	104.8945 (72)
Total internal gains	523.4297	520.7579	502.3044	472.4719	441.6017	412.6265	394.3725	401.3806	417.2523	447.3217	481.7042	508.0443 (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				10.5400	10.6334		0.6300		0.7000	0.7700	34.2519 (74)	
West				5.5000	19.6403		0.6300		0.7000	0.7700	33.0128 (80)	
Solar gains	67.2646	130.0370	217.5816	333.7710	430.7657	452.2412	425.8080	349.9799	257.4257	154.5477	83.4171	55.7021 (83)
Total gains	590.6943	650.7949	719.8860	806.2428	872.3674	864.8677	820.1805	751.3605	674.6780	601.8693	565.1213	563.7465 (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	86.1828	86.4532	86.7198	87.9947	88.2374	89.3851	89.3851	89.6009	88.9395	88.2374	87.7478	87.2417
alpha	6.7455	6.7635	6.7813	6.8663	6.8825	6.9590	6.9590	6.9734	6.9293	6.8825	6.8499	6.8161
util living area	0.9998	0.9995	0.9982	0.9895	0.9406	0.7810	0.5955	0.6698	0.9273	0.9953	0.9995	0.9998 (86)
MIT	20.0609	20.1545	20.3338	20.5947	20.8346	20.9697	20.9959	20.9914	20.8932	20.5935	20.2871	20.0488 (87)
Th 2	20.2483	20.2505	20.2526	20.2627	20.2646	20.2734	20.2734	20.2750	20.2700	20.2646	20.2608	20.2568 (88)
util rest of house	0.9997	0.9993	0.9975	0.9852	0.9161	0.7116	0.5011	0.5726	0.8874	0.9928	0.9992	0.9998 (89)
MIT 2	18.9617	19.1004	19.3643	19.7511	20.0857	20.2509	20.2716	20.2709	20.1701	19.7529	19.3026	18.9506 (90)
Living area fraction	19.1498	19.2808	19.5302	19.8955	20.2139	20.3740	20.3956	20.3942	20.2939	19.8967	19.4711	19.1386 (92)
MIT	19.1498	19.2808	19.5302	19.8955	20.2139	20.3740	20.3956	20.3942	20.2939	19.8967	19.4711	19.1386 (93)
Temperature adjustment												0.0000
adjusted MIT	19.1498	19.2808	19.5302	19.8955	20.2139	20.3740	20.3956	20.3942	20.2939	19.8967	19.4711	19.1386 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9995	0.9990	0.9965	0.9823	0.9141	0.7219	0.5173	0.5892	0.8890	0.9910	0.9989	0.9997 (94)
Useful gains	590.4180	650.1182	717.3884	791.9828	797.3883	624.3178	424.2597	442.6949	599.8021	596.4622	564.4918	563.5571 (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	1730.3585	1670.4660	1508.9314	1254.8574	968.9731	648.7006	426.4312	447.6643	699.3654	1058.0694	1415.8238	1719.5719 (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	848.1157	685.6737	588.9080	333.2697	127.6591	0.0000	0.0000	0.0000	0.0000	343.4358	612.9591	860.0750 (98)
Space heating												4400.0961 (98)
Space heating per m2										(98) / (4) =		30.4273 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4705.9851 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	848.1157	685.6737	588.9080	333.2697	127.6591	0.0000	0.0000	0.0000	0.0000	343.4358	612.9591	860.0750 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	907.0757	733.3409	629.8481	356.4382	136.5338	0.0000	0.0000	0.0000	0.0000	367.3110	655.5712	919.8663 (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	198.6033	174.5433	182.1161	161.6005	157.1650	138.7111	131.5795	146.6412	147.0897	167.6515	179.3544	193.2668 (64)
Efficiency of water heater (217)m	88.2547	88.1030	87.7218	86.7036	84.2654	79.8000	79.8000	79.8000	79.8000	86.6872	87.8340	79.8000 (216)
Fuel for water heating, kWh/month	225.0343	198.1128	207.6065	186.3827	186.5119	173.8235	164.8867	183.7610	184.3229	193.3983	204.1970	218.8083 (219)
Water heating fuel used												2326.8458 (219)
Annual totals kWh/year												
Space heating fuel - main system												4705.9851 (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)												559.3735 (232)
Total delivered energy for all uses												7667.2045 (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	4705.9851	0.2160	1016.4928 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2326.8458	0.2160	502.5987 (264)
Space and water heating			1519.0915 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	559.3735	0.5190	290.3148 (268)
Total CO2, kg/m2/year			1848.3313 (272)
Emissions per m2 for space and water heating			10.5047 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.0076 (272b)
Emissions per m2 for pumps and fans			0.2692 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.5047 * 1.55) + 2.0076 + 0.2692, rounded to 2 d.p.			18.5600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3528 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2999 (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	0.3824	0.3749	0.3674	0.3299	0.3224	0.2849	0.2849	0.2774	0.2999	0.3224	0.3374	0.3524 (22b)
Effective ac	0.5731	0.5703	0.5675	0.5544	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5569	0.5621 (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
N Window (Uw = 1.40)			16.0400	1.3258	21.2652		(27)
External Wall -Type 4	78.5600	16.0400	62.5200	0.1900	11.8788		(29a)
Roof Joist	32.4900		32.4900	0.1500	4.8735		(30)
Total net area of external elements Aum(A, m ²)			111.0500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0175		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0617 (36)
Total fabric heat loss						(33) + (36) =	48.0792 (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	73.5698	73.2054	72.8482	71.1704	70.8565	69.3952	69.3952	69.1246	69.9581	70.8565	71.4915	72.1554 (38)
Heat transfer coeff	121.6490	121.2846	120.9274	119.2496	118.9357	117.4744	117.4744	117.2038	118.0373	118.9357	119.5707	120.2346 (39)
Average = Sum(39)m / 12 =												119.2481 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8412	0.8387	0.8362	0.8246	0.8225	0.8124	0.8124	0.8105	0.8162	0.8225	0.8268	0.8314 (40)
HLP (average)												0.8246 (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												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.0459	109.8988	105.7517	101.6046	97.4574	93.3103	93.3103	97.4574	101.6046	105.7517	109.8988	114.0459 (44)
Energy conte	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Energy content (annual)										Total = Sum(45)m =		1631.2606 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

35.9395 31.4329 32.4359 28.2784 27.1338 23.4144 21.6969 24.8975 25.1949 29.3622 32.0511 34.8054 (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	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7542	27.3156	22.2146	16.8179	12.5715	10.6134	11.4682	14.9068	20.0078	25.4045	29.6509	31.6090	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.5954	317.8599	309.6334	292.1202	270.0130	249.2353	235.3545	232.0900	240.3164	257.8296	279.9369	300.7146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	(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)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	(71)
Water heating gains (Table 5)	48.3057	46.7751	43.5967	39.2756	36.4702	32.5200	29.1625	33.4644	34.9929	39.4653	44.5154	46.7815	(72)
Total internal gains	460.5362	458.8315	442.3255	415.0946	385.9356	359.2496	342.8661	347.3420	362.1981	389.5804	420.9841	445.9860	(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				10.5400	10.6334	0.5400	0.8000	0.7700	33.5528 (74)			
West				5.5000	19.6403	0.5400	0.8000	0.7700	32.3390 (80)			
Solar gains	65.8919	127.3832	213.1411	326.9593	421.9745	443.0118	417.1181	342.8375	252.1721	151.3936	81.7147	54.5654 (83)
Total gains	526.4281	586.2147	655.4667	742.0539	807.9101	802.2614	759.9841	690.1795	614.3701	540.9740	502.6988	500.5513 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.0208	33.1200	33.2178	33.6852	33.7741	34.1942	34.1942	34.2732	34.0311	33.7741	33.5947	33.4092	
alpha	3.2014	3.2080	3.2145	3.2457	3.2516	3.2796	3.2796	3.2849	3.2687	3.2516	3.2396	3.2273	
util living area	0.9901	0.9852	0.9731	0.9403	0.8683	0.7409	0.6041	0.6648	0.8603	0.9606	0.9854	0.9916	(86)
MIT	18.9106	19.0957	19.4536	19.9625	20.4362	20.7797	20.9191	20.8876	20.6006	20.0004	19.3769	18.8842	(87)
Th 2	20.2177	20.2199	20.2220	20.2320	20.2339	20.2426	20.2426	20.2443	20.2393	20.2339	20.2301	20.2262	(88)
util rest of house	0.9887	0.9830	0.9688	0.9301	0.8435	0.6887	0.5222	0.5863	0.8246	0.9520	0.9829	0.9904	(89)
MIT 2	18.2589	18.4448	18.8022	19.3114	19.7692	20.0883	20.1991	20.1800	19.9347	19.3548	18.7333	18.2387	(90)
Living area fraction									fLA = Living area / (4) =			0.1711	(91)
MIT	18.3704	18.5562	18.9137	19.4228	19.8833	20.2066	20.3224	20.3011	20.0486	19.4653	18.8435	18.3492	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3704	18.5562	18.9137	19.4228	19.8833	20.2066	20.3224	20.3011	20.0486	19.4653	18.8435	18.3492	(93)

8. Space heating requirement

Utilisation	0.9840	0.9766	0.9595	0.9168	0.8305	0.6860	0.5314	0.5927	0.8141	0.9409	0.9767	0.9863	(94)
Useful gains	518.0056	572.5122	628.9247	680.3017	670.9300	550.3305	403.8374	409.0717	500.1393	509.0254	490.9714	493.6982	(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	1711.6555	1656.2862	1501.1513	1254.8444	973.2905	658.6315	437.2833	457.2196	702.1598	1054.4043	1404.1770	1701.2202	(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	888.0756	728.2961	648.9366	413.6707	224.9562	0.0000	0.0000	0.0000	0.0000	405.7619	657.5080	898.3964	(98)
Space heating												4865.6016	(98)
Space heating per m ²												33.6464	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	1104.2597	869.3108	890.7491	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7515	0.8204	0.7836	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	829.8267	713.2074	697.9920	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1062.8381	1010.6345	931.8391	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	167.7682	221.2857	173.9822	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												563.0362	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	41.9421	55.3214	43.4956	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												140.7590 (107)
Space cooling per m2												0.9734 (108)
Energy for space heating												33.6464 (99)
Energy for space cooling												0.9734 (108)
Total												34.6197 (109)
Dwelling Fabric Energy Efficiency (DFEE)												34.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1028 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3528 (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) =		0.2999 (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	0.3824	0.3749	0.3674	0.3299	0.3224	0.2849	0.2849	0.2774	0.2999	0.3224	0.3374	0.3524 (22b)
Effective ac	0.5731	0.5703	0.5675	0.5544	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5569	0.5621 (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
TER Opening Type (Uw = 1.40)			16.0400	1.3258	21.2652		(27)
External Wall -Type 4	78.5600	16.0400	62.5200	0.1800	11.2536		(29a)
Roof Joist	32.4900		32.4900	0.1300	4.2237		(30)
Total net area of external elements Aum(A, m ²)			111.0500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.7425		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2118 (36)
Total fabric heat loss						(33) + (36) =	42.9542 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	73.5698	73.2054	72.8482	71.1704	70.8565	69.3952	69.3952
Heat transfer coeff	116.5240	116.1596	115.8024	114.1246	113.8107	112.3494	112.3494
Average = Sum(39)m / 12 =							114.1231 (39)
HLP	0.8058	0.8033	0.8008	0.7892	0.7870	0.7769	0.7769
HLP (average)							0.7960 (40)
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
Daily hot water use	114.0459	109.8988	105.7517	101.6046	97.4574	93.3103	93.3103	97.4574	101.6046	105.7517	109.8988	114.0459 (44)
Energy conte	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Energy content (annual)										Total = Sum(45)m =		1631.2606 (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	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

35.9395 31.4329 32.4359 28.2784 27.1338 23.4144 21.6969 24.8975 25.1949 29.3622 32.0511 34.8054 (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	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	146.2697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.6740	28.1326	22.8790	17.3209	12.9475	10.9309	11.8112	15.3526	20.6062	26.1644	30.5377	32.5544	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.5954	317.8599	309.6334	292.1202	270.0130	249.2353	235.3545	232.0900	240.3164	257.8296	279.9369	300.7146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	37.6270	(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)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	(71)
Water heating gains (Table 5)	48.3057	46.7751	43.5967	39.2756	36.4702	32.5200	29.1625	33.4644	34.9929	39.4653	44.5154	46.7815	(72)
Total internal gains	461.4560	459.6485	442.9899	415.5976	386.3116	359.5671	343.2091	347.7879	362.7965	390.3402	421.8709	446.9314	(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			10.5400	10.6334	0.6300	0.7000	0.7700	34.2519 (74)				
West			5.5000	19.6403	0.6300	0.7000	0.7700	33.0128 (80)				

Solar gains	67.2646	130.0370	217.5816	333.7710	430.7657	452.2412	425.8080	349.9799	257.4257	154.5477	83.4171	55.7021 (83)
Total gains	528.7207	589.6855	660.5715	749.3685	817.0773	811.8082	769.0171	697.7678	620.2221	544.8879	505.2880	502.6335 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

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	86.1828	86.4532	86.7198	87.9947	88.2374	89.3851	89.3851	89.6009	88.9395	88.2374	87.7478	87.2417	21.0000 (85)
alpha	6.7455	6.7635	6.7813	6.8663	6.8825	6.9590	6.9590	6.9734	6.9293	6.8825	6.8499	6.8161	
util living area	0.9999	0.9997	0.9989	0.9931	0.9559	0.8155	0.6319	0.7132	0.9498	0.9974	0.9997	0.9999	(86)
MIT	20.0180	20.1122	20.2931	20.5574	20.8071	20.9603	20.9941	20.9875	20.8677	20.5548	20.2457	20.0064	(87)
Th 2	20.2483	20.2505	20.2526	20.2627	20.2646	20.2734	20.2734	20.2750	20.2700	20.2646	20.2608	20.2568	(88)
util rest of house	0.9999	0.9996	0.9985	0.9901	0.9361	0.7485	0.5334	0.6136	0.9186	0.9960	0.9996	0.9999	(89)
MIT 2	19.3270	19.4230	19.6056	19.8770	20.1186	20.2526	20.2716	20.2707	20.1816	19.8771	19.5652	19.3226	(90)
Living area fraction	19.4452	19.5410	19.7232	19.9935	20.2365	20.3737	20.3953	20.3934	20.2990	19.9931	19.6817	19.4396	(92)
Temperature adjustment	19.4452	19.5410	19.7232	19.9935	20.2365	20.3737	20.3953	20.3934	20.2990	19.9931	19.6817	19.4396	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9995	0.9981	0.9887	0.9352	0.7586	0.5504	0.6307	0.9201	0.9952	0.9995	0.9999	(94)
Useful gains	528.6116	589.3873	659.3147	740.8821	764.0903	615.8020	423.2330	440.1042	570.6645	542.2906	505.0365	502.5619	(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	1764.7847	1700.6921	1531.2805	1266.0395	971.5396	648.6768	426.3977	447.5762	699.9463	1069.0327	1439.9173	1754.2291	(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	919.7128	746.7968	648.7425	378.1133	154.3423	0.0000	0.0000	0.0000	0.0000	391.8961	673.1142	931.2404	(98)
Space heating												4843.9584	(98)
Space heating per m2												33.4967	(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	1056.0847	831.3858	851.7991	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8818	0.9449	0.9137	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.2037	785.6069	778.3212	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1074.4193	1021.6491	941.3020	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	103.1153	175.6154	121.2577	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												399.9884	(104)
Cooled fraction												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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	25.7788	43.9039	30.3144	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												99.9971 (107)
Space cooling per m2												0.6915 (108)
Energy for space heating												33.4967 (99)
Energy for space cooling												0.6915 (108)
Total												34.1882 (109)
Target Fabric Energy Efficiency (TFEE)												39.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (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					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					5.0000
Infiltration rate					0.2500 (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) =		0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.2391	0.2284	0.2338	0.2125	0.2125	0.1966	0.1966	0.1806	0.1966	0.2072	0.2019	0.2178 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												64.4000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.4171	0.4064	0.4118	0.3905	0.3905	0.3746	0.3746	0.3586	0.3746	0.3852	0.3799	0.3958 (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
N Window (Uw = 1.40)			16.0400	1.3258	21.2652		(27)
External Wall -Type 4	78.5600	16.0400	62.5200	0.1900	11.8788		(29a)
Roof Joist	32.4900		32.4900	0.1500	4.8735		(30)
Total net area of external elements Aum(A, m ²)			111.0500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.0175		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0617 (36)
Total fabric heat loss						(33) + (36) =	48.0792 (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	53.5384	52.1745	52.8565	50.1286	50.1286	48.0827	48.0827	46.0368	48.0827	49.4466	48.7647	50.8106 (38)
Heat transfer coeff	101.6176	100.2537	100.9357	98.2078	98.2078	96.1619	96.1619	94.1160	96.1619	97.5258	96.8439	98.8898 (39)
Average = Sum(39)m / 12 =												97.9236 (39)
HLP	0.7027	0.6933	0.6980	0.6791	0.6791	0.6650	0.6650	0.6508	0.6650	0.6744	0.6697	0.6838 (40)
HLP (average)												0.6772 (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												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.0459	109.8988	105.7517	101.6046	97.4574	93.3103	93.3103	97.4574	101.6046	105.7517	109.8988	114.0459 (44)
Energy content (annual)	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Distribution loss (46)m = 0.15 x (45)m												1631.2606 (45)
Water storage loss:	25.3690	22.1879	22.8959	19.9612	19.1533	16.5278	15.3155	17.5747	17.7846	20.7262	22.6243	24.5685 (46)
Store volume												10.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.5000 (48)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Temperature factor from Table 2b												1.0000 (49)
Enter (49) or (54) in (55)												0.5000 (55)
Total storage loss	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	(56)
If cylinder contains dedicated solar storage	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408	202.5527 (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	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408	202.5527 (64)
RHI water heating demand	87.2446	77.1922	81.7626	74.2570	73.4664	66.6463	64.9592	69.9672	69.4321	76.9531	80.1602	85.4702 (65)
Heat gains from water heating, kWh/month												2088 (64)
												2088 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8855	68.2891	55.5364	42.0446	31.4288	26.5336	28.6704	37.2669	50.0196	63.5114	74.1271	79.0224	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	469.5453	474.4177	462.1394	436.0003	403.0044	371.9929	351.2753	346.4029	358.6812	384.8203	417.8162	448.8277	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	(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)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	(71)
Water heating gains (Table 5)	117.2642	114.8693	109.8959	103.1347	98.7451	92.5643	87.3107	94.0419	96.4335	103.4316	111.3336	114.8793	(72)
Total internal gains	777.6808	771.5617	741.5574	695.1653	647.1640	605.0764	581.2422	591.6974	619.1200	665.7489	717.2626	756.7151	(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					10.5400	11.9814	0.5400	0.8000	0.7700		37.8065
West					5.5000	22.3313	0.5400	0.8000	0.7700		36.7700 (74)
Solar gains	74.5765	130.2939	218.5033	344.5642	429.9662	482.5349	449.6569	376.3213	277.6542	165.6560	92.4398
Total gains	852.2573	901.8557	960.0607	1039.7295	1077.1302	1087.6113	1030.8991	968.0187	896.7742	831.4049	809.7025
											61.0803 (83)
											817.7954 (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	39.5300	40.0678	39.7971	40.9025	40.9025	41.7727	41.7727	42.6808	41.7727	41.1885	41.4786	40.6204
alpha	3.6353	3.6712	3.6531	3.7268	3.7268	3.7848	3.7848	3.8454	3.7848	3.7459	3.7652	3.7080
util living area	0.9538	0.9393	0.9013	0.8133	0.6622	0.4463	0.2963	0.3274	0.5942	0.8334	0.9274	0.9578 (86)
MIT	19.7816	19.9478	20.2419	20.6101	20.8642	20.9783	20.9967	20.9954	20.9345	20.6401	20.2039	19.7936 (87)
Th 2	20.3384	20.3468	20.3426	20.3593	20.3593	20.3719	20.3719	20.3845	20.3719	20.3635	20.3677	20.3551 (88)
util rest of house	0.9481	0.9319	0.8890	0.7911	0.6246	0.3963	0.2391	0.2694	0.5434	0.8086	0.9175	0.9526 (89)
MIT 2	18.6876	18.9323	19.3493	19.8744	20.2088	20.3531	20.3700	20.3817	20.3083	19.9261	19.3173	18.7167 (90)
Living area fraction	18.8748	19.1061	19.5021	20.0003	20.3209	20.4601	20.4773	20.4868	20.4155	20.0483	19.4690	18.9010 (91)
MIT	18.8748	19.1061	19.5021	20.0003	20.3209	20.4601	20.4773	20.4868	20.4155	20.0483	19.4690	18.9010 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8748	19.1061	19.5021	20.0003	20.3209	20.4601	20.4773	20.4868	20.4155	20.0483	19.4690	18.9010 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(97)
Useful gains	0.9323	0.9148	0.8707	0.7775	0.6222	0.4035	0.2488	0.2791	0.5471	0.7949	0.9006	0.9378	(98)
Ext temp.	794.5781	825.0589	835.8867	808.3735	670.2236	438.8038	256.4387	270.2109	490.6125	660.9029	729.2023	766.9192	(99)
Heat loss rate W	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(100)
Month fracti	1430.2497	1374.0845	1231.6284	1011.5680	738.6154	448.1278	257.4527	271.6900	520.7606	843.4335	1139.7561	1394.4446	(101)
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	(102)
Space heating	472.9397	368.9452	294.4318	146.3000	50.8835	0.0000	0.0000	0.0000	0.0000	135.8028	295.5987	466.8789	(103)
RHI space heating demand												2231.7807	(104)
												2232	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (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					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					5.0000
Infiltration rate					0.2500 (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) =		0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												64.4000 (23c)
Effective ac	0.4489	0.4436	0.4383	0.4118	0.4064	0.3799	0.3799	0.3746	0.3905	0.4064	0.4171	0.4277 (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
N Window (Uw = 1.40)			16.0400	1.3258	21.2652		(27)
External Wall -Type 4	78.5600	16.0400	62.5200	0.1900	11.8788		(29a)
Roof Joist	32.4900		32.4900	0.1500	4.8735		(30)
Total net area of external elements Aum(A, m ²)			111.0500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.0175		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0617 (36)
Total fabric heat loss						(33) + (36) =	48.0792 (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	57.6302	56.9483	56.2663	52.8565	52.1745	48.7647	48.7647	48.0827	50.1286	52.1745	53.5384	54.9024 (38)
Heat transfer coeff	105.7094	105.0275	104.3455	100.9357	100.2537	96.8439	96.8439	96.1619	98.2078	100.2537	101.6176	102.9816 (39)
Average = Sum(39)m / 12 =												100.7652 (39)
HLP	0.7310	0.7263	0.7216	0.6980	0.6933	0.6697	0.6697	0.6650	0.6791	0.6933	0.7027	0.7121 (40)
HLP (average)												0.6968 (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												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.0459	109.8988	105.7517	101.6046	97.4574	93.3103	93.3103	97.4574	101.6046	105.7517	109.8988	114.0459 (44)
Energy content (annual)	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.3690	22.1879	22.8959	19.9612	19.1533	16.5278	15.3155	17.5747	17.7846	20.7262	22.6243	24.5685 (46)	
Water storage loss:												
Store volume												10.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.5000 (48)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Temperature factor from Table 2b												1.0000 (49)
Enter (49) or (54) in (55)												0.5000 (55)
Total storage loss	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	(56)
If cylinder contains dedicated solar storage	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408	202.5527 (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	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408	202.5527 (64)
Heat gains from water heating, kWh/month	87.2446	77.1922	81.7626	74.2570	73.4664	66.6463	64.9592	69.9672	69.4321	76.9531	80.1602	85.4702 (65)
Total per year (kWh/year) = Sum(64)m =												2087.6566 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	76.8855	68.2891	55.5364	42.0446	31.4288	26.5336	28.6704	37.2669	50.0196	63.5114	74.1271	79.0224 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	469.5453	474.4177	462.1394	436.0003	403.0044	371.9929	351.2753	346.4029	358.6812	384.8203	417.8162	448.8277 (68)
Pumps, fans	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158 (71)
Total internal gains	117.2642	114.8693	109.8959	103.1347	98.7451	92.5643	87.3107	94.0419	96.4335	103.4316	111.3336	114.8793 (72)
	777.6808	771.5617	741.5574	695.1653	647.1640	605.0764	581.2422	591.6974	619.1200	665.7489	717.2626	756.7151 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d			Gains W
North					10.5400	10.6334	0.5400	0.8000	0.7700			33.5528 (74)
West					5.5000	19.6403	0.5400	0.8000	0.7700			32.3390 (80)

Solar gains	65.8919	127.3832	213.1411	326.9593	421.9745	443.0118	417.1181	342.8375	252.1721	151.3936	81.7147	54.5654 (83)
Total gains	843.5726	898.9449	954.6985	1022.1246	1069.1386	1048.0882	998.3602	934.5349	871.2921	817.1426	798.9773	811.2805 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	37.9999	38.2466	38.4966	39.7971	40.0678	41.4786	41.4786	41.7727	40.9025	40.0678	39.5300	39.0064
util living area	3.5333	3.5498	3.5664	3.6531	3.6712	3.7652	3.7652	3.7848	3.7268	3.6712	3.6353	3.6004
MIT	0.9602	0.9473	0.9186	0.8489	0.7292	0.5550	0.4167	0.4582	0.6803	0.8699	0.9411	0.9641 (86)
MIT	19.6192	19.7846	20.0773	20.4820	20.7758	20.9434	20.9851	20.9790	20.8747	20.5130	20.0342	19.6195 (87)
Th 2	20.3135	20.3177	20.3218	20.3426	20.3468	20.3677	20.3677	20.3719	20.3593	20.3468	20.3384	20.3301 (88)
util rest of house	0.9553	0.9409	0.9085	0.8303	0.6971	0.5084	0.3602	0.4004	0.6354	0.8500	0.9329	0.9598 (89)
MIT 2	18.4361	18.6772	19.1001	19.6854	20.0854	20.3119	20.3562	20.3550	20.2272	19.7394	19.0539	18.4477 (90)
Living area fraction	18.6386	18.8667	19.2674	19.8217	20.2036	20.4200	20.4639	20.4618	20.3381	19.8718	19.2216	18.6483 (92)
MIT	18.6386	18.8667	19.2674	19.8217	20.2036	20.4200	20.4639	20.4618	20.3381	19.8718	19.2216	18.6483 (93)
Temperature adjustment												0.0000
adjusted MIT	18.6386	18.8667	19.2674	19.8217	20.2036	20.4200	20.4639	20.4618	20.3381	19.8718	19.2216	18.6483 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9399	0.9237	0.8895	0.8137	0.6896	0.5124	0.3689	0.4089	0.6338	0.8334	0.9159	0.9454 (94)
Ext temp.	792.8321	830.3574	849.2275	831.7299	737.2621	537.0452	368.3235	382.0922	552.2619	681.0282	731.7466	767.0115 (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	1515.7215	1466.8903	1332.2187	1102.3909	852.5133	563.6341	374.1909	390.5927	612.6253	929.5298	1231.7732	1487.9037 (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	537.8297	427.7501	359.3455	194.8760	85.7469	0.0000	0.0000	0.0000	0.0000	184.8852	360.0191	536.3438 (98)
Space heating per m2												2686.7963 (98)
												(98) / (4) = 18.5796 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	910.3324	716.6446	730.8304	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8641	0.9141	0.8923	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	786.6251	655.0499	652.1136	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1122.8824	1068.7828	992.4166	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	242.1052	307.8172	253.1854	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												803.1079	(104)
Intermittency factor (Table 10b)													
FC = cooled area / (4) =												0.5017	(105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	30.3657	38.6075	31.7554	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2												100.7286	(107)
												0.6966	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2686.7963	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2821.1361	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2087.6566	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2192.0394	(310a)
Electricity used for heat distribution	50.1318	(313)
Cooling System Energy Efficiency Ratio	6.7500	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	14.9228	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1060)		
mechanical ventilation fans (SFP = 1.1060)	524.8867	(330a)
Total electricity for the above, kWh/year	524.8867	(331)
Electricity for lighting (calculated in Appendix L)	543.1291	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.32 * 951 * 0.80) =	-803.0804	(333)
Total delivered energy for all uses	5293.0337	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	2821.1361	4.2400	119.6162	(340a)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2192.0394	4.2400	92.9425	(342a)
Space cooling	14.9228	13.1900	1.9683	(348)
Mechanical ventilation fans	524.8867	13.1900	69.2326	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	543.1291	13.1900	71.6387	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(352)
Total energy cost			475.3982	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0530 (357)
SAP value	85.3101	
SAP rating (Section 12)	85	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367a)
Space heating from Heat pump	1671.0585	0.5190	867.2794	(367)
Electrical energy for heat distribution	50.1318	0.5190	26.0184	(372)
Total CO2 associated with community systems			893.2977	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			893.2977	(376)
Space cooling	14.9228	0.5190	7.7449	(377)
Pumps and fans	524.8867	0.5190	272.4162	(378)
Energy for lighting	543.1291	0.5190	281.8840	(379)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-803.0804	0.5190	-416.7987 (380)
Total kg/year			1038.5441 (383)
CO2 emissions per m2			7.1800 (384)
EI value			92.6605 (384a)
EI rating			93 (385)
EI band			A

----- Calculation of stars for heating and DHW -----

Space heating energy efficiency	$1.00 \times 4.240 \times 1.05$	
= 4.452, stars = 4		
Space heating environmental impact	$1.00 \times 0.519 \times 1.05 / 3.0000$	
= 0.1817, stars = 5		
Water heating energy efficiency		4.452, stars = 4
Water heating environmental impact		0.1817, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.6100 (1b)	x 2.6900 (2b)	= 389.0009 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 389.0009 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.2500 (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) =				0.2125 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Adj infilt rate	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
	0.2391	0.2284	0.2338	0.2125	0.2125	0.1966	0.1966	0.1806	0.1966	0.2072	0.2019	0.2178 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												64.4000 (23c)
Effective ac	0.4171	0.4064	0.4118	0.3905	0.3905	0.3746	0.3746	0.3586	0.3746	0.3852	0.3799	0.3958 (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					
N Window (Uw = 1.40)			16.0400	1.3258	21.2652		(27)					
External Wall -Type 4	78.5600	16.0400	62.5200	0.1900	11.8788		(29a)					
Roof Joist	32.4900		32.4900	0.1500	4.8735		(30)					
Total net area of external elements Aum(A, m2)			111.0500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		38.0175		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0617 (36)					
Total fabric heat loss							(33) + (36) = 48.0792 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.5384	Feb 52.1745	Mar 52.8565	Apr 50.1286	May 50.1286	Jun 48.0827	Jul 48.0827	Aug 46.0368	Sep 48.0827	Oct 49.4466	Nov 48.7647	Dec 50.8106 (38)
Heat transfer coeff	101.6176	100.2537	100.9357	98.2078	98.2078	96.1619	96.1619	94.1160	96.1619	97.5258	96.8439	98.8898 (39)
Average = Sum(39)m / 12 =	97.9236 (39)											
HLP	Jan 0.7027	Feb 0.6933	Mar 0.6980	Apr 0.6791	May 0.6791	Jun 0.6650	Jul 0.6650	Aug 0.6508	Sep 0.6650	Oct 0.6744	Nov 0.6697	Dec 0.6838 (40)
HLP (average)	0.6772 (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												2.9254 (42)
Average daily hot water use (litres/day)												103.6781 (43)
Daily hot water use	Jan 114.0459	Feb 109.8988	Mar 105.7517	Apr 101.6046	May 97.4574	Jun 93.3103	Jul 93.3103	Aug 97.4574	Sep 101.6046	Oct 105.7517	Nov 109.8988	Dec 114.0459 (44)
Energy conte	169.1268	147.9194	152.6396	133.0749	127.6885	110.1855	102.1030	117.1647	118.5641	138.1750	150.8288	163.7903 (45)
Energy content (annual)												Total = Sum(45)m = 1631.2606 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3690	22.1879	22.8959	19.9612	19.1533	16.5278	15.3155	17.5747	17.7846	20.7262	22.6243	24.5685 (46)
Water storage loss:												10.0000 (47)
Store volume												0.5000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Temperature factor from Table 2b												1.0000 (49)
Enter (49) or (54) in (55)												0.5000 (55)
Total storage loss	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	15.0000	15.5000	15.0000	15.5000 (56)
If cylinder contains dedicated solar storage	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	15.0000	15.5000	15.0000	15.5000 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408	202.5527 (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	207.8892	182.9306	191.4020	170.5869	166.4509	147.6975	140.8654	155.9271	156.0761	176.9374	188.3408	202.5527 (64)
Heat gains from water heating, kWh/month	87.2446	77.1922	81.7626	74.2570	73.4664	66.6463	64.9592	69.9672	69.4321	76.9531	80.1602	85.4702 (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	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	175.5237	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8855	68.2891	55.5364	42.0446	31.4288	26.5336	28.6704	37.2669	50.0196	63.5114	74.1271	79.0224	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	469.5453	474.4177	462.1394	436.0003	403.0044	371.9929	351.2753	346.4029	358.6812	384.8203	417.8162	448.8277	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	55.4778	(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)	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	-117.0158	(71)
Water heating gains (Table 5)	117.2642	114.8693	109.8959	103.1347	98.7451	92.5643	87.3107	94.0419	96.4335	103.4316	111.3336	114.8793	(72)
Total internal gains	777.6808	771.5617	741.5574	695.1653	647.1640	605.0764	581.2422	591.6974	619.1200	665.7489	717.2626	756.7151	(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			10.5400		11.9814		0.5400		0.8000		0.7700		37.8065 (74)	
West			5.5000		22.3313		0.5400		0.8000		0.7700		36.7700 (80)	
Solar gains	74.5765	130.2939	218.5033	344.5642	429.9662	482.5349	449.6569	376.3213	277.6542	165.6560	92.4398	61.0803 (83)		
Total gains	852.2573	901.8557	960.0607	1039.7295	1077.1302	1087.6113	1030.8991	968.0187	896.7742	831.4049	809.7025	817.7954 (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	39.5300	40.0678	39.7971	40.9025	40.9025	41.7727	41.7727	42.6808	41.7727	41.1885	41.4786	40.6204
alpha	3.6353	3.6712	3.6531	3.7268	3.7268	3.7848	3.7848	3.8454	3.7848	3.7459	3.7652	3.7080
util living area	0.9538	0.9393	0.9013	0.8133	0.6622	0.4463	0.2963	0.3274	0.5942	0.8334	0.9274	0.9578 (86)
MIT	19.7816	19.9478	20.2419	20.6101	20.8642	20.9783	20.9967	20.9954	20.9345	20.6401	20.2039	19.7936 (87)
Th 2	20.3384	20.3468	20.3426	20.3593	20.3593	20.3719	20.3719	20.3845	20.3719	20.3635	20.3677	20.3551 (88)
util rest of house	0.9481	0.9319	0.8890	0.7911	0.6246	0.3963	0.2391	0.2694	0.5434	0.8086	0.9175	0.9526 (89)
MIT 2	18.6876	18.9323	19.3493	19.8744	20.2088	20.3531	20.3700	20.3817	20.3083	19.9261	19.3173	18.7167 (90)
Living area fraction									fLA = Living area / (4) =			0.1711 (91)
MIT	18.8748	19.1061	19.5021	20.0003	20.3209	20.4601	20.4773	20.4868	20.4155	20.0483	19.4690	18.9010 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8748	19.1061	19.5021	20.0003	20.3209	20.4601	20.4773	20.4868	20.4155	20.0483	19.4690	18.9010 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9323	0.9148	0.8707	0.7775	0.6222	0.4035	0.2488	0.2791	0.5471	0.7949	0.9006	0.9378	(94)
Ext temp.	794.5781	825.0589	835.8867	808.3735	670.2236	438.8038	256.4387	270.2109	490.6125	660.9029	729.2023	766.9192	(95)
Heat loss rate W	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Month fracti	1430.2497	1374.0845	1231.6284	1011.5680	738.6154	448.1278	257.4527	271.6900	520.7606	843.4335	1139.7561	1394.4446	(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	472.9397	368.9452	294.4318	146.3000	50.8835	0.0000	0.0000	0.0000	0.0000	135.8028	295.5987	466.8789	(98)
Space heating per m2												2231.7807 (98)	
												(98) / (4) =	15.4331 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	788.5276	596.2038	602.3424	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9135	0.9532	0.9432	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	720.3491	568.3041	568.1573	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1169.0783	1106.8152	1031.5535	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	323.0850	400.6523	344.7667	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1068.5040	(104)
Cooled fraction									fC = cooled area / (4) =			0.5017	(105)
Intermittency factor (Table 10b)													
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.5225	50.2512	43.2419	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												134.0156	(107)
Space cooling per m2												0.9267	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2231.7807	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2343.3697	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2087.6566	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2192.0394	(310a)
Electricity used for heat distribution	45.3541	(313)
Cooling System Energy Efficiency Ratio	6.7500	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	19.8542	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1060)		
mechanical ventilation fans (SFP = 1.1060)	524.8867	(330a)
Total electricity for the above, kWh/year	524.8867	(331)
Electricity for lighting (calculated in Appendix L)	543.1291	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.32 * 1019 * 0.80) =	-860.5606	(333)
Total delivered energy for all uses	4762.7185	(338)

10b. Fuel costs - using BEDF prices (520)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	2343.3697	11.8800	278.3923	(340a)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2192.0394	11.8800	260.4143	(342a)
Space cooling	19.8542	36.8500	7.3163	(348)
Mechanical ventilation fans	524.8867	36.8500	193.4207	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	543.1291	36.8500	200.1431	(350)
Additional standing charges			104.0000	(351)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(352)
Total energy cost			1043.6867	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367a)
Space heating from Heat pump	1511.8030	0.5190	784.6258	(367)
Electrical energy for heat distribution	45.3541	0.5190	23.5388	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			808.1645	(373)
Space and water heating			808.1645	(376)
Space cooling	19.8542	0.5190	10.3043	(377)
Pumps and fans	524.8867	0.5190	272.4162	(378)
Energy for lighting	543.1291	0.5190	281.8840	(379)
Energy saving/generation technologies				
PV Unit	-860.5606	0.5190	-446.6309	(380)
Total kg/year			926.1381	(383)

13b. Primary energy - Community heating scheme

Energy Primary energy factor Primary energy

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	kWh/year	kg CO2/kWh	kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1511.8030	3.0700	4641.2353 (367)
Electrical energy for heat distribution	45.3541	3.0700	139.2371 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4780.4724 (373)
Space and water heating			4780.4724 (376)
Space cooling	19.8542	3.0700	60.9523 (377)
Pumps and fans	524.8867	3.0700	1611.4022 (378)
Energy for lighting	543.1291	3.0700	1667.4064 (379)
Energy saving/generation technologies			
PV Unit	-860.5606	3.0700	-2641.9210 (380)
Primary energy kWh/year			5478.3122 (383)
Primary energy kWh/m2/year			37.8834 (384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: A 93

(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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 520 TEST (05 Jun 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£401	£401	£0
Community scheme	£643	£643	£0
Space heating	£576	£576	£0
Space cooling	£7	£7	£0
Water heating	£260	£260	£0
Lighting	£200	£200	£0
Total cost of fuels	£1044	£1044	£0
Total cost of uses	£1043	£1043	£0
Delivered energy	33 kWh/m²	33 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	38 kWh/m²	38 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type SemiDetached Flat
Number of storeys 1
Cross ventilation possible No
SAP Region Thames Valley
Front of dwelling faces East
Overshading Average or unknown
Thermal mass parameter 100.0
Night ventilation No
Ventilation rate during hot weather (ach) 4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient 513.48 (P1)
Transmission heat loss coefficient 48.08 (37)
Summer heat loss coefficient 561.56 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
North	10.5400	81.1852	0.5400	0.8000	0.7650	254.5101
West	5.5000	117.5071	0.5400	0.8000	0.7650	192.2270
total:						446.7371

	Jun	Jul	Aug	
Solar gains	479	447	376	(P3)
Internal gains	605	581	592	
Total summer gains	1084	1028	968	(P5)
Summer gain/loss ratio	1.93	1.83	1.72	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.23	21.03	20.82	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			