

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 1033 Plot 2			Issued on Date	07/12/2025
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	92 A	DER	6.77	TER	17.02
Environmental	96 A	% DER<TER	60.21		
CO ₂ Emissions (t/year)	0.25	DFEE	30.39	TFEE	46.32
General Requirements Compliance	Pass	% DFEE<TFEE	34.40		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client					

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

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DWELLING AS DESIGNED

Mid-Terrace House, total floor area 84 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) 17.02 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 46.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 30.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing East: 4.11 m², No overhang
Windows facing West: 10.25 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.000 W/m²K
Photovoltaic array 1.32 kW

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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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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					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) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3870 (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) =	0.3290 (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	0.4194	0.4112	0.4030	0.3619	0.3536	0.3125	0.3125	0.3043	0.3290	0.3536	0.3701	0.3865 (22b)
Effective ac	0.5880	0.5845	0.5812	0.5655	0.5625	0.5488	0.5488	0.5463	0.5541	0.5625	0.5685	0.5747 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			14.3600	1.1450	16.4427		(27)
Heat Loss Floor 1			41.9400	0.1200	5.0328	75.0000	3145.5000 (28a)
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300	43.4900	1456.9150 (29a)
External Roof 1	41.9400		41.9400	0.0900	3.7746	10.3700	434.9178 (30)
Total net area of external elements Aum(A, m ²)			133.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6121		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Party Wall 2			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.9400			18.0000	754.9200 (32d)
Internal Ceiling 1			41.9400			18.0000	754.9200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17604.4828 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							209.8770 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							0.0000 (36)
Total fabric heat loss						(33) + (36) =	33.6121 (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	41.5009	41.2599	41.0236	39.9136	39.7060	38.7393	38.7393	38.5602	39.1116	39.7060	40.1261	40.5653 (38)
Heat transfer coeff	75.1131	74.8720	74.6357	73.5258	73.3181	72.3514	72.3514	72.1724	72.7238	73.3181	73.7382	74.1774 (39)
Average = Sum(39)m / 12 =												73.5248 (39)
HLP	0.8955	0.8926	0.8898	0.8766	0.8741	0.8626	0.8626	0.8604	0.8670	0.8741	0.8791	0.8843 (40)
HLP (average)												0.8765 (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												2.5324 (42)
Average daily hot water use (litres/day)												94.3438 (43)
Daily hot water use	103.7782	100.0044	96.2307	92.4569	88.6832	84.9094	84.9094	88.6832	92.4569	96.2307	100.0044	103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)

Energy content (annual)												Total = Sum(45)m =	1484.3955 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.0850	20.1903	20.8346	18.1641	17.4289	15.0398	13.9366	15.9924	16.1834	18.8602	20.5874	22.3566 (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	0.6705	0.6057	0.6015	0.5038	0.4637	0.3831	0.3550	0.4255	0.4489	0.5445	0.6176	0.6494 (61)	
Total heat required for water heating calculated for each month	154.5706	135.2077	139.4987	121.5977	116.6562	100.6484	93.2655	107.0417	108.3384	126.2793	137.8670	149.6934 (62)	
WWHRS	-56.9553	-50.1121	-51.1466	-42.0906	-39.0864	-32.2476	-27.2979	-33.0495	-34.0111	-42.0382	-48.6870	-55.0479 eq. (G10)	
Total of WWHRS savings												-511.7702	
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	97.6153	85.0956	88.3521	79.5072	77.5698	68.4009	65.9676	73.9922	74.3273	84.2411	89.1800	94.6454 (64)	
												Total per year (kWh/year) = Sum(64)m =	978.8944 (64)
Heat gains from water heating, kWh/month	51.3394	44.9066	46.3337	40.3897	38.7499	33.4340	30.9815	35.5563	35.9855	41.9430	45.7898	49.7195 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8786	18.5442	15.0812	11.4174	8.5346	7.2053	7.7856	10.1200	13.5830	17.2468	20.1296	21.4589 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.3583	229.7176	223.7723	211.1155	195.1386	180.1225	170.0909	167.7316	173.6769	186.3337	202.3106	217.3267 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619 (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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948 (71)
Water heating gains (Table 5)	69.0046	66.8253	62.2765	56.0968	52.0832	46.4361	41.6418	47.7907	49.9798	56.3749	63.5970	66.8272 (72)
Total internal gains	381.2271	379.0726	365.1155	342.6153	319.7420	297.7495	283.5038	289.6278	301.2253	323.9410	350.0227	369.5984 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
East				4.1100	19.6403	0.6300		0.7000	0.7700		24.6695	
West				10.2500	19.6403	0.6300		0.7000	0.7700		(76)	
Solar gains	86.1933	168.6124	277.6806	404.9806	496.3190	508.0708	483.7041	415.4947	322.9540	200.0728	107.4729	70.8812 (83)
Total gains	467.4204	547.6850	642.7961	747.5959	816.0610	805.8202	767.2079	705.1225	624.1794	524.0138	457.4956	440.4795 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} , (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.1036	65.3132	65.5200	66.5091	66.6975	67.5887	67.5887	67.7563	67.2426	66.6975	66.3175	65.9248
alpha	5.3402	5.3542	5.3680	5.4339	5.4465	5.5059	5.5059	5.5171	5.4828	5.4465	5.4212	5.3950
util living area												
	0.9968	0.9920	0.9743	0.9079	0.7603	0.5627	0.4130	0.4669	0.7410	0.9555	0.9930	0.9976 (86)
MIT	19.9322	20.1027	20.3818	20.7131	20.9164	20.9869	20.9980	20.9962	20.9465	20.6437	20.2244	19.9048 (87)
Th 2	20.1713	20.1738	20.1762	20.1875	20.1896	20.1994	20.1994	20.2013	20.1956	20.1896	20.1853	20.1808 (88)
util rest of house												
	0.9959	0.9898	0.9674	0.8851	0.7126	0.4970	0.3389	0.3878	0.6748	0.9395	0.9907	0.9970 (89)
MIT 2	19.1873	19.3587	19.6353	19.9587	20.1339	20.1931	20.1988	20.2000	20.1656	19.9028	19.4899	19.1677 (90)
Living area fraction									fLA = Living area / (4) =			0.2195 (91)
MIT	19.3508	19.5220	19.7991	20.1243	20.3056	20.3674	20.3742	20.3748	20.3370	20.0654	19.6511	19.3295 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3508	19.5220	19.7991	20.1243	20.3056	20.3674	20.3742	20.3748	20.3370	20.0654	19.6511	19.3295 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9947	0.9876	0.9635	0.8831	0.7198	0.5111	0.3552	0.4051	0.6872	0.9366	0.9888	0.9961 (94)
Useful gains	464.9584	540.8914	619.3327	660.2128	587.4058	411.8314	272.4743	285.6737	428.9330	490.7957	452.3649	438.7525 (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	1130.5106	1094.7787	992.5882	825.2746	630.9498	417.2764	273.0708	286.8683	453.5745	693.9881	925.4964	1122.2665 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	495.1708	372.2123	277.7021	118.8445	32.3967	0.0000	0.0000	0.0000	0.0000	151.1751	340.6547	508.5344 (98)
Space heating												2296.6905 (98)
Space heating per m2												27.3807 (99)
										(98) / (4) =		

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2546.2201 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	495.1708	372.2123	277.7021	118.8445	32.3967	0.0000	0.0000	0.0000	0.0000	151.1751	340.6547	508.5344 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	548.9698	412.6522	307.8737	131.7567	35.9165	0.0000	0.0000	0.0000	0.0000	167.5999	377.6660	563.7853 (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	97.6153	85.0956	88.3521	79.5072	77.5698	68.4009	65.9676	73.9922	74.3273	84.2411	89.1800	94.6454 (64)
Efficiency of water heater (217)m	87.5946	87.2669	86.4318	84.1102	80.0061	76.4000	76.4000	76.4000	76.4000	84.7238	86.9418	76.4000 (216)
Fuel for water heating, kWh/month	111.4399	97.5119	102.2217	94.5274	96.9548	89.5299	86.3451	96.8484	97.2871	99.4303	102.5744	107.9023 (219)
Water heating fuel used												1182.5733 (219)
Annual totals kWh/year												
Space heating fuel - main system												2546.2201 (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)												368.7228 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.32 * 853 * 1.00) =												-900.7996
Total delivered energy for all uses												-900.7996 (233)
												3271.7165 (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	2546.2201	0.2160	549.9835 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1182.5733	0.2160	255.4358 (264)
Space and water heating			805.4194 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.7228	0.5190	191.3671 (268)
Energy saving/generation technologies			
PV Unit	-900.7996	0.5190	-467.5150 (269)
Total CO2, kg/year			568.1965 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.7700 (273)

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

DER		6.7700 ZC1
Total Floor Area	TFA	83.8800
Assumed number of occupants	N	2.5324
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.0620 ZC2
CO2 emissions from cooking, equation (L16)		2.1433 ZC3
Total CO2 emissions		24.9752 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		24.9752 ZC8

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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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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																3 * 10 =	30.0000 (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) =				30.0000	/ (5) =	0.1403 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3903 (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) =							0.3317 (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	0.4229	0.4146	0.4064	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3898	(22b)				
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5696	0.5760	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)				
TER Opening Type (Uw = 1.40)			14.3600	1.3258	19.0379			(27)				
Heat Loss Floor 1			41.9400	0.1300	5.4522			(28a)				
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300			(29a)				
External Roof 1	41.9400		41.9400	0.1300	5.4522			(30)				
Total net area of external elements Aum(A, m2)			133.8600					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		38.5163			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								8.7090 (36)				
Total fabric heat loss						(33) + (36) =		47.2253 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.6056	Feb 41.3604	Mar 41.1201	Apr 39.9915	May 39.7804	Jun 38.7973	Jul 38.7973	Aug 38.6153	Sep 39.1760	Oct 39.7804	Nov 40.2075	Dec 40.6541 (38)
Heat transfer coeff	88.8309	88.5857	88.3454	87.2168	87.0056	86.0226	86.0226	85.8406	86.4013	87.0056	87.4328	87.8794 (39)
Average = Sum(39)m / 12 =												87.2158 (39)
HLP	Jan 1.0590	Feb 1.0561	Mar 1.0532	Apr 1.0398	May 1.0373	Jun 1.0255	Jul 1.0255	Aug 1.0234	Sep 1.0301	Oct 1.0373	Nov 1.0424	Dec 1.0477 (40)
HLP (average)												1.0398 (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												2.5324 (42)
Average daily hot water use (litres/day)												94.3438 (43)
Daily hot water use	Jan 103.7782	Feb 100.0044	Mar 96.2307	Apr 92.4569	May 88.6832	Jun 84.9094	Jul 84.9094	Aug 88.6832	Sep 92.4569	Oct 96.2307	Nov 100.0044	Dec 103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)
Energy content (annual)										Total = Sum(45)m =		1484.3955 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.0850	20.1903	20.8346	18.1641	17.4289	15.0398	13.9366	15.9924	16.1834	18.8602	20.5874	22.3566 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.0381	45.5952	45.1920	41.8731	43.2689	45.1920	45.5952	49.0381	49.3151	50.9589 (61)
Solar input	204.8590	180.6294	187.9353	166.6891	161.3845	142.1384	136.1795	151.8082	153.4847	174.7730	186.5645	200.0029 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	204.8590	180.6294	187.9353	166.6891	161.3845	142.1384	136.1795	151.8082	153.4847	174.7730	186.5645	200.0029 (64)
	63.9115	56.2620	58.4428	51.6625	49.9320	43.8065	41.7100	46.7479	47.2721	54.0664	57.9642	62.2969 (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	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8786	18.5442	15.0812	11.4174	8.5346	7.2053	7.7856	10.1200	13.5830	17.2468	20.1296	21.4589	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.3583	229.7176	223.7723	211.1155	195.1386	180.1225	170.0909	167.7316	173.6769	186.3337	202.3106	217.3267	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	(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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	(71)
Water heating gains (Table 5)	85.9025	83.7232	78.5522	71.7535	67.1129	60.8424	56.0618	62.8332	65.6557	72.6698	80.5058	83.7323	(72)
Total internal gains	398.1250	395.9706	381.3912	358.2720	334.7717	312.1557	297.9238	304.6703	316.9011	340.2359	366.9315	386.5034	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
East					4.1100	19.6403	0.6300	0.7000	0.7700			24.6695 (76)
West					10.2500	19.6403	0.6300	0.7000	0.7700			61.5238 (80)

Solar gains	86.1933	168.6124	277.6806	404.9806	496.3190	508.0708	483.7041	415.4947	322.9540	200.0728	107.4729	70.8812 (83)
Total gains	484.3183	564.5830	659.0718	763.2526	831.0906	820.2265	781.6279	720.1650	639.8552	540.3087	474.4045	457.3846 (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	65.5741	65.7555	65.9344	66.7876	66.9497	67.7147	67.7147	67.8583	67.4180	66.9497	66.6226	66.2840	
alpha	5.3716	5.3837	5.3956	5.4525	5.4633	5.5143	5.5143	5.5239	5.4945	5.4633	5.4415	5.4189	
util living area	0.9984	0.9959	0.9863	0.9460	0.8338	0.6447	0.4796	0.5392	0.8146	0.9750	0.9963	0.9988	(86)
MIT	19.8615	20.0158	20.2809	20.6192	20.8671	20.9751	20.9959	20.9925	20.9142	20.5678	20.1519	19.8368	(87)
Th 2	20.0344	20.0368	20.0392	20.0503	20.0524	20.0621	20.0621	20.0639	20.0584	20.0524	20.0482	20.0438	(88)
util rest of house	0.9978	0.9945	0.9816	0.9274	0.7834	0.5612	0.3799	0.4342	0.7416	0.9630	0.9949	0.9984	(89)
MIT 2	18.5096	18.7364	19.1224	19.6074	19.9258	20.0461	20.0606	20.0608	19.9908	19.5466	18.9440	18.4802	(90)
Living area fraction	18.8063	19.0172	19.3767	19.8295	20.1324	20.2500	20.2659	20.2653	20.1935	19.7707	19.2091	18.7780	(91)
MIT	18.8063	19.0172	19.3767	19.8295	20.1324	20.2500	20.2659	20.2653	20.1935	19.7707	19.2091	18.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8063	19.0172	19.3767	19.8295	20.1324	20.2500	20.2659	20.2653	20.1935	19.7707	19.2091	18.7780	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9924	0.9772	0.9221	0.7881	0.5786	0.4018	0.4573	0.7533	0.9583	0.9930	0.9976	(94)
Ext temp.	482.7393	560.2756	644.0326	703.8147	655.0146	474.5958	314.0828	329.3087	482.0029	517.7623	471.0673	456.2750	(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	1288.6071	1250.5834	1137.5968	953.2324	733.6693	486.0267	315.3469	331.7997	526.4865	797.9066	1058.7332	1281.1022	(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	599.5657	463.8869	367.2117	179.5807	58.5190	0.0000	0.0000	0.0000	0.0000	208.4274	423.1195	613.6714	(98)
Space heating per m2												2913.9823	(98)
												34.7399	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3119.8954 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	599.5657	463.8869	367.2117	179.5807	58.5190	0.0000	0.0000	0.0000	0.0000	208.4274	423.1195	613.6714	(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)	641.9333	496.6669	393.1603	192.2706	62.6542	0.0000	0.0000	0.0000	0.0000	223.1556	453.0187	657.0358	(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	204.8590	180.6294	187.9353	166.6891	161.3845	142.1384	136.1795	151.8082	153.4847	174.7730	186.5645	200.0029	(64)
Efficiency of water heater	87.5942	87.3219	86.7080	85.2390	82.7606	80.3000	80.3000	80.3000	80.3000	85.4955	87.0496	87.6890	(216)
Fuel for water heating, kWh/month	233.8726	206.8546	216.7451	195.5551	195.0016	177.0093	169.5884	189.0513	191.1391	204.4236	214.3198	228.0822	(219)
Water heating fuel used												2421.6427	(219)
Annual totals kWh/year													
Space heating fuel - main system												3119.8954	(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)												368.7228	(232)
Total delivered energy for all uses												5985.2608	(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	3119.8954	0.2160	673.8974 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2421.6427	0.2160	523.0748 (264)
Space and water heating			1196.9722 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.7228	0.5190	191.3671 (268)
Total CO2, kg/m2/year			1427.2643 (272)
Emissions per m2 for space and water heating			14.2701 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2814 (272b)
Emissions per m2 for pumps and fans			0.4641 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2701 * 1.00) + 2.2814 + 0.4641, rounded to 2 d.p.			17.0200 (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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1403 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3403 (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) =	0.2892 (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	0.3688	0.3615	0.3543	0.3181	0.3109	0.2748	0.2748	0.2675	0.2892	0.3109	0.3254	0.3398 (22b)
Effective ac	0.5680	0.5653	0.5628	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			14.3600	1.1450	16.4427		(27)
Heat Loss Floor 1			41.9400	0.1200	5.0328	75.0000	3145.5000 (28a)
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300	43.4900	1456.9150 (29a)
External Roof 1	41.9400		41.9400	0.0900	3.7746	10.3700	434.9178 (30)
Total net area of external elements Aum(A, m ²)			133.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6121		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Party Wall 2			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.9400			18.0000	754.9200 (32d)
Internal Ceiling 1			41.9400			9.0000	377.4600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17227.0228 (34)
205.3770 (35)
0.0000 (36)
(33) + (36) = 33.6121 (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	40.0915	39.9052	39.7225	38.8646	38.7040	37.9568	37.9568	37.8184	38.2446	38.7040	39.0288	39.3683 (38)
Heat transfer coeff	73.7037	73.5173	73.3347	72.4767	72.3162	71.5689	71.5689	71.4306	71.8568	72.3162	72.6409	72.9804 (39)
Average = Sum(39)m / 12 =												72.4759 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8787	0.8765	0.8743	0.8641	0.8621	0.8532	0.8532	0.8516	0.8567	0.8621	0.8660	0.8701 (40)
HLP (average)												0.8640 (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
Average daily hot water use (litres/day)
2.5324 (42)
94.3438 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.7782	100.0044	96.2307	92.4569	88.6832	84.9094	84.9094	88.6832	92.4569	96.2307	100.0044	103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1484.3955 (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	32.7038	28.6029	29.5157	25.7325	24.6909	21.3064	19.7435	22.6559	22.9265	26.7187	29.1655	31.6718 (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	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8786	18.5442	15.0812	11.4174	8.5346	7.2053	7.7856	10.1200	13.5830	17.2468	20.1296	21.4589	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.3583	229.7176	223.7723	211.1155	195.1386	180.1225	170.0909	167.7316	173.6769	186.3337	202.3106	217.3267	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	(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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	(71)
Water heating gains (Table 5)	43.9567	42.5639	39.6716	35.7395	33.1867	29.5922	26.5369	30.4515	31.8424	35.9122	40.5076	42.5697	(72)
Total internal gains	353.1792	351.8112	339.5106	319.2580	297.8455	277.9056	265.3990	269.2887	280.0879	300.4782	323.9334	342.3408	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East					4.1100	19.6403		0.6300		0.7000		0.7700		24.6695
West					10.2500	19.6403		0.6300		0.7000		0.7700		61.5238 (80)
Solar gains	86.1933	168.6124	277.6806	404.9806	496.3190	508.0708	483.7041	415.4947	322.9540	200.0728	107.4729	70.8812 (83)		
Total gains	439.3725	520.4236	617.1912	724.2386	794.1644	785.9763	749.1030	684.7834	603.0419	500.5510	431.4063	413.2220 (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	64.9260	65.0906	65.2527	66.0251	66.1717	66.8626	66.8626	66.9921	66.5948	66.1717	65.8759	65.5694	
alpha	5.3284	5.3394	5.3502	5.4017	5.4114	5.4575	5.4575	5.4661	5.4397	5.4114	5.3917	5.3713	
util living area	0.9973	0.9930	0.9764	0.9123	0.7664	0.5696	0.4182	0.4753	0.7519	0.9601	0.9941	0.9981	(86)
MIT	19.9036	20.0772	20.3621	20.6999	20.9113	20.9856	20.9977	20.9957	20.9410	20.6231	20.1943	19.8724	(87)
Th 2	20.1857	20.1876	20.1894	20.1982	20.1998	20.2074	20.2074	20.2089	20.2045	20.1998	20.1965	20.1930	(88)
util rest of house	0.9966	0.9911	0.9701	0.8906	0.7198	0.5041	0.3440	0.3958	0.6871	0.9458	0.9923	0.9976	(89)
MIT 2	19.1719	19.3460	19.6284	19.9570	20.1400	20.2004	20.2067	20.2074	20.1707	19.8933	19.4706	19.1467	(90)
Living area fraction	19.3325	19.5065	19.7895	20.1200	20.3093	20.3727	20.3803	20.3804	20.3398	20.0535	19.6295	19.3060	(91)
MIT	19.3325	19.5065	19.7895	20.1200	20.3093	20.3727	20.3803	20.3804	20.3398	20.0535	19.6295	19.3060	(92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
adjusted MIT	19.3325	19.5065	19.7895	20.1200	20.3093	20.3727	20.3803	20.3804	20.3398	20.0535	19.6295	19.3060	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	437.4478	514.7581	596.4021	643.3207	576.9776	407.1935	269.8878	282.9551	421.4385	471.8472	427.3191	411.8918	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1107.9491	1073.8314	974.5788	813.1897	622.5916	413.1471	270.5553	284.3217	448.3710	683.6376	910.1524	1102.4431	(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	498.8530	375.6972	281.3635	122.3057	33.9368	0.0000	0.0000	0.0000	0.0000	157.5721	347.6400	513.7702	(98)
Space heating													2331.1385 (98)
Space heating per m2													(98) / (4) = 27.7914 (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	672.7480	529.6102	542.8723	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9614	0.9828	0.9734	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	646.7556	520.5268	528.4184	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1013.6680	968.6103	895.1143	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	264.1769	333.3741	272.8218	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												870.3728 (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	66.0442	83.3435	68.2054	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												217.5932 (107)
Space cooling per m2												2.5941 (108)
Energy for space heating												27.7914 (99)
Energy for space cooling												2.5941 (108)
Total												30.3855 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.4 (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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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																3 * 10 =	30.0000 (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) =					30.0000	/ (5) =	0.1403 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3903 (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) =							0.3317 (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	0.4229	0.4146	0.4064	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3898	(22b)				
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5696	0.5760	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)				
TER Opening Type (Uw = 1.40)			14.3600	1.3258	19.0379			(27)				
Heat Loss Floor 1			41.9400	0.1300	5.4522			(28a)				
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300			(29a)				
External Roof 1	41.9400		41.9400	0.1300	5.4522			(30)				
Total net area of external elements Aum(A, m2)			133.8600					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		38.5163			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								8.7090 (36)				
Total fabric heat loss						(33) + (36) =		47.2253 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.6056	Feb 41.3604	Mar 41.1201	Apr 39.9915	May 39.7804	Jun 38.7973	Jul 38.7973	Aug 38.6153	Sep 39.1760	Oct 39.7804	Nov 40.2075	Dec 40.6541 (38)
Heat transfer coeff	88.8309	88.5857	88.3454	87.2168	87.0056	86.0226	86.0226	85.8406	86.4013	87.0056	87.4328	87.8794 (39)
Average = Sum(39)m / 12 =												87.2158 (39)
HLP	Jan 1.0590	Feb 1.0561	Mar 1.0532	Apr 1.0398	May 1.0373	Jun 1.0255	Jul 1.0255	Aug 1.0234	Sep 1.0301	Oct 1.0373	Nov 1.0424	Dec 1.0477 (40)
HLP (average)												1.0398 (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												2.5324 (42)
Average daily hot water use (litres/day)												94.3438 (43)
Daily hot water use	Jan 103.7782	Feb 100.0044	Mar 96.2307	Apr 92.4569	May 88.6832	Jun 84.9094	Jul 84.9094	Aug 88.6832	Sep 92.4569	Oct 96.2307	Nov 100.0044	Dec 103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)
Energy content (annual)										Total = Sum(45)m =		1484.3955 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)
	32.7038	28.6029	29.5157	25.7325	24.6909	21.3064	19.7435	22.6559	22.9265	26.7187	29.1655	31.6718 (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	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	126.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8786	18.5442	15.0812	11.4174	8.5346	7.2053	7.7856	10.1200	13.5830	17.2468	20.1296	21.4589	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.3583	229.7176	223.7723	211.1155	195.1386	180.1225	170.0909	167.7316	173.6769	186.3337	202.3106	217.3267	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	35.6619	(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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	(71)
Water heating gains (Table 5)	43.9567	42.5639	39.6716	35.7395	33.1867	29.5922	26.5369	30.4515	31.8424	35.9122	40.5076	42.5697	(72)
Total internal gains	353.1792	351.8112	339.5106	319.2580	297.8455	277.9056	265.3990	269.2887	280.0879	300.4782	323.9334	342.3408	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.1100	19.6403	0.6300	0.7000	0.7700	24.6695 (76)			
West				10.2500	19.6403	0.6300	0.7000	0.7700	61.5238 (80)			

Solar gains	86.1933	168.6124	277.6806	404.9806	496.3190	508.0708	483.7041	415.4947	322.9540	200.0728	107.4729	70.8812 (83)
Total gains	439.3725	520.4236	617.1912	724.2386	794.1644	785.9763	749.1030	684.7834	603.0419	500.5510	431.4063	413.2220 (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	65.5741	65.7555	65.9344	66.7876	66.9497	67.7147	67.7147	67.8583	67.4180	66.9497	66.6226	66.2840	
alpha	5.3716	5.3837	5.3956	5.4525	5.4633	5.5143	5.5143	5.5239	5.4945	5.4633	5.4415	5.4189	
util living area	0.9990	0.9972	0.9898	0.9558	0.8531	0.6678	0.4994	0.5646	0.8411	0.9820	0.9977	0.9993	(86)
MIT	19.8108	19.9665	20.2363	20.5852	20.8495	20.9706	20.9950	20.9906	20.8982	20.5275	20.1036	19.7867	(87)
Th 2	20.0344	20.0368	20.0392	20.0503	20.0524	20.0621	20.0621	20.0639	20.0584	20.0524	20.0482	20.0438	(88)
util rest of house	0.9986	0.9962	0.9862	0.9398	0.8054	0.5832	0.3961	0.4559	0.7721	0.9729	0.9967	0.9990	(89)
MIT 2	18.9427	19.1000	19.3696	19.7169	19.9529	20.0490	20.0608	20.0612	20.0021	19.6690	19.2464	18.9262	(90)
Living area fraction									fLA = Living area / (4) =			0.2195	(91)
MIT	19.1332	19.2902	19.5599	19.9075	20.1497	20.2512	20.2659	20.2652	20.1987	19.8574	19.4345	19.1151	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1332	19.2902	19.5599	19.9075	20.1497	20.2512	20.2659	20.2652	20.1987	19.8574	19.4345	19.1151	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	438.5690	517.9389	607.1923	678.5718	643.9738	472.4226	313.7938	328.6394	472.6409	485.7786	429.6322	412.6784	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1317.6466	1274.7632	1153.7783	960.0346	735.1687	486.1339	315.3463	331.7918	526.9390	805.4477	1078.4413	1310.7297	(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	654.0338	508.5859	406.6599	202.6532	67.8490	0.0000	0.0000	0.0000	0.0000	237.8338	467.1426	668.1502	(98)
Space heating												3212.9084	(98)
Space heating per m2												38.3036	(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	808.6127	636.5674	652.3885	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9245	0.9638	0.9459	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	747.5711	613.5128	617.0783	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1013.6680	968.6103	895.1143	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	191.5898	264.1925	206.8588	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												662.6411	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	47.8974	66.0481	51.7147	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											165.6603 (107)
Space cooling per m2											1.9750 (108)
Energy for space heating											38.3036 (99)
Energy for space cooling											1.9750 (108)
Total											40.2786 (109)
Target Fabric Energy Efficiency (TFEE)											46.3 (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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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					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) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3870 (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) =	0.3290 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4194	0.3865	0.3783	0.3536	0.3536	0.3290	0.3290	0.3207	0.3290	0.3701	0.3619	0.3865 (22b)
Effective ac	0.5880	0.5747	0.5716	0.5625	0.5625	0.5541	0.5541	0.5514	0.5541	0.5685	0.5655	0.5747 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			14.3600	1.1450	16.4427		(27)
Heat Loss Floor 1			41.9400	0.1200	5.0328	75.0000	3145.5000 (28a)
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300	43.4900	1456.9150 (29a)
External Roof 1	41.9400		41.9400	0.0900	3.7746	10.3700	434.9178 (30)
Total net area of external elements Aum(A, m ²)			133.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6121		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Party Wall 2			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.9400			18.0000	754.9200 (32d)
Internal Ceiling 1			41.9400			18.0000	754.9200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17604.4828 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 209.8770 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.0000 (36)
Total fabric heat loss (33) + (36) = 33.6121 (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	41.5009	40.5653	40.3433	39.7060	39.7060	39.1116	39.1116	38.9230	39.1116	40.1261	39.9136	40.5653 (38)
Heat transfer coeff	75.1131	74.1774	73.9554	73.3181	73.3181	72.7238	72.7238	72.5352	72.7238	73.7382	73.5258	74.1774 (39)
Average = Sum(39)m / 12 =												73.5025 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8955	0.8843	0.8817	0.8741	0.8741	0.8670	0.8670	0.8647	0.8670	0.8791	0.8766	0.8843 (40)
HLP (average)												0.8763 (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 2.5324 (42)
Average daily hot water use (litres/day) 94.3438 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.7782	100.0044	96.2307	92.4569	88.6832	84.9094	84.9094	88.6832	92.4569	96.2307	100.0044	103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1484.3955 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.0850	20.1903	20.8346	18.1641	17.4289	15.0398	13.9366	15.9924	16.1834	18.8602	20.5874	22.3566 (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	0.6705	0.6057	0.6015	0.5038	0.4637	0.3831	0.3550	0.4255	0.4489	0.5445	0.6176	0.6494 (61)
Total heat required for water heating calculated for each month	154.5706	135.2077	139.4987	121.5977	116.6562	100.6484	93.2655	107.0417	108.3384	126.2793	137.8670	149.6934 (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	154.5706	135.2077	139.4987	121.5977	116.6562	100.6484	93.2655	107.0417	108.3384	126.2793	137.8670	149.6934 (64)
RHI water heating demand	51.3394	44.9066	46.3337	40.3897	38.7499	33.4340	30.9815	35.5563	35.9855	41.9430	45.7898	49.7195 (65)
Heat gains from water heating, kWh/month	51.3394	44.9066	46.3337	40.3897	38.7499	33.4340	30.9815	35.5563	35.9855	41.9430	45.7898	49.7195 (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	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1965	46.3605	37.7029	28.5435	21.3366	18.0133	19.4640	25.3000	33.9576	43.1170	50.3239	53.6472	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.3408	342.8621	333.9885	315.0978	291.2516	268.8396	253.8670	250.3457	259.2192	278.1099	301.9561	324.3681	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	(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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	(71)
Water heating gains (Table 5)	69.0046	66.8253	62.2765	56.0968	52.0832	46.4361	41.6418	47.7907	49.9798	56.3749	63.5970	66.8272	(72)
Total internal gains	566.9159	562.4218	540.3419	506.1121	471.0455	439.6629	421.3467	429.8103	449.5307	483.9759	522.2510	551.2166	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East				4.1100	25.9136	0.6300			0.7000	0.7700	32.5493 (76)	
West				10.2500	25.9136	0.6300			0.7000	0.7700	81.1754 (80)	

Solar gains	113.7247	189.9673	310.0918	458.1464	534.4609	591.3705	549.8120	483.5816	381.6153	238.1553	140.4919	89.3001 (83)
Total gains	680.6406	752.3891	850.4337	964.2585	1005.5064	1031.0334	971.1587	913.3919	831.1460	722.1312	662.7429	640.5167 (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	65.1036	65.9248	66.1227	66.6975	66.6975	67.2426	67.2426	67.4174	67.2426	66.3175	66.5091	65.9248
alpha	5.3402	5.3950	5.4082	5.4465	5.4465	5.4828	5.4828	5.4945	5.4828	5.4212	5.4339	5.3950
util living area	0.9762	0.9605	0.9076	0.7788	0.5953	0.3935	0.2769	0.2936	0.5176	0.8167	0.9478	0.9807 (86)
MIT	20.3130	20.4403	20.6722	20.8845	20.9765	20.9979	20.9998	20.9997	20.9916	20.8796	20.5944	20.2919 (87)
Th 2	20.1713	20.1808	20.1831	20.1896	20.1896	20.1956	20.1956	20.1976	20.1956	20.1853	20.1875	20.1808 (88)
util rest of house	0.9702	0.9511	0.8877	0.7412	0.5433	0.3377	0.2168	0.2300	0.4513	0.7721	0.9334	0.9757 (89)
MIT 2	19.5631	19.6941	19.9143	20.1056	20.1758	20.1948	20.1956	20.1975	20.1919	20.1027	19.8501	19.5509 (90)
Living area fraction	19.7277	19.8579	20.0807	20.2765	20.3515	20.3711	20.3721	20.3736	20.3674	20.2732	20.0134	0.2195 (91)
MIT	19.7277	19.8579	20.0807	20.2765	20.3515	20.3711	20.3721	20.3736	20.3674	20.2732	20.0134	19.7135 (92)
Temperature adjustment	19.7277	19.8579	20.0807	20.2765	20.3515	20.3711	20.3721	20.3736	20.3674	20.2732	20.0134	0.0000
adjusted MIT	19.7277	19.8579	20.0807	20.2765	20.3515	20.3711	20.3721	20.3736	20.3674	20.2732	20.0134	19.7135 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9663	0.9468	0.8849	0.7454	0.5539	0.3499	0.2300	0.2440	0.4657	0.7773	0.9298	0.9722	(94)
Ext temp.	657.7252	712.3431	752.5356	718.7662	556.9934	360.7650	223.3596	222.8688	387.0305	561.3337	616.1918	622.6945	(95)
Heat loss rate W	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Month fracti	1076.1950	1050.1931	945.1986	782.7830	568.3286	361.5160	223.4141	222.9415	390.3388	624.8019	853.8878	1054.3201	(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)
RHI space heating demand	311.3415	227.0352	143.3413	46.0921	8.4333	0.0000	0.0000	0.0000	0.0000	47.2204	171.1411	321.1295	(98)
Space heating	311.3415	227.0352	143.3413	46.0921	8.4333	0.0000	0.0000	0.0000	0.0000	47.2204	171.1411	321.1295	(98)
RHI space heating demand	311.3415	227.0352	143.3413	46.0921	8.4333	0.0000	0.0000	0.0000	0.0000	47.2204	171.1411	321.1295	(98)

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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3870 (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) =	0.3290 (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	0.4194	0.4112	0.4030	0.3619	0.3536	0.3125	0.3125	0.3043	0.3290	0.3536	0.3701	0.3865 (22b)
Effective ac	0.5880	0.5845	0.5812	0.5655	0.5625	0.5488	0.5488	0.5463	0.5541	0.5625	0.5685	0.5747 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			14.3600	1.1450	16.4427		(27)
Heat Loss Floor 1			41.9400	0.1200	5.0328	75.0000	3145.5000 (28a)
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300	43.4900	1456.9150 (29a)
External Roof 1	41.9400		41.9400	0.0900	3.7746	10.3700	434.9178 (30)
Total net area of external elements Aum(A, m ²)			133.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6121		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Party Wall 2			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.9400			18.0000	754.9200 (32d)
Internal Ceiling 1			41.9400			18.0000	754.9200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17604.4828 (34)
209.8770 (35)
0.0000 (36)
(33) + (36) = 33.6121 (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	41.5009	41.2599	41.0236	39.9136	39.7060	38.7393	38.7393	38.5602	39.1116	39.7060	40.1261	40.5653 (38)
Heat transfer coeff	75.1131	74.8720	74.6357	73.5258	73.3181	72.3514	72.3514	72.1724	72.7238	73.3181	73.7382	74.1774 (39)
Average = Sum(39)m / 12 =												73.5248 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8955	0.8926	0.8898	0.8766	0.8741	0.8626	0.8626	0.8604	0.8670	0.8741	0.8791	0.8843 (40)
HLP (average)												0.8765 (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
Average daily hot water use (litres/day)
2.5324 (42)
94.3438 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.7782	100.0044	96.2307	92.4569	88.6832	84.9094	84.9094	88.6832	92.4569	96.2307	100.0044	103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)

Energy content (annual)												Total = Sum(45)m =	1484.3955 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.0850	20.1903	20.8346	18.1641	17.4289	15.0398	13.9366	15.9924	16.1834	18.8602	20.5874	22.3566 (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	0.6705	0.6057	0.6015	0.5038	0.4637	0.3831	0.3550	0.4255	0.4489	0.5445	0.6176	0.6494 (61)	
Total heat required for water heating calculated for each month													
	154.5706	135.2077	139.4987	121.5977	116.6562	100.6484	93.2655	107.0417	108.3384	126.2793	137.8670	149.6934 (62)	
WWHRS	-56.9553	-50.1121	-51.1466	-42.0906	-39.0864	-32.2476	-27.2979	-33.0495	-34.0111	-42.0382	-48.6870	-55.0479 eq. (G10)	
Total of WWHRS savings												-511.7702	
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	97.6153	85.0956	88.3521	79.5072	77.5698	68.4009	65.9676	73.9922	74.3273	84.2411	89.1800	94.6454 (64)	
												Total per year (kWh/year) = Sum(64)m =	978.8944 (64)
Heat gains from water heating, kWh/month													
	51.3394	44.9066	46.3337	40.3897	38.7499	33.4340	30.9815	35.5563	35.9855	41.9430	45.7898	49.7195 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1965	46.3605	37.7029	28.5435	21.3366	18.0133	19.4640	25.3000	33.9576	43.1170	50.3239	53.6472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.3408	342.8621	333.9885	315.0978	291.2516	268.8396	253.8670	250.3457	259.2192	278.1099	301.9561	324.3681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266 (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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948 (71)
Water heating gains (Table 5)	69.0046	66.8253	62.2765	56.0968	52.0832	46.4361	41.6418	47.7907	49.9798	56.3749	63.5970	66.8272 (72)
Total internal gains	566.9159	562.4218	540.3419	506.1121	471.0455	439.6629	421.3467	429.8103	449.5307	483.9759	522.2510	551.2166 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
East				4.1100	19.6403	0.6300		0.7000	0.7700		24.6695	
West				10.2500	19.6403	0.6300		0.7000	0.7700		61.5238 (76)	
Solar gains	86.1933	168.6124	277.6806	404.9806	496.3190	508.0708	483.7041	415.4947	322.9540	200.0728	107.4729	70.8812 (83)
Total gains	653.1092	731.0342	818.0225	911.0927	967.3644	947.7337	905.0508	845.3050	772.4847	684.0487	629.7239	622.0978 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.1036	65.3132	65.5200	66.5091	66.6975	67.5887	67.5887	67.7563	67.2426	66.6975	66.3175	65.9248
alpha	5.3402	5.3542	5.3680	5.4339	5.4465	5.5059	5.5059	5.5171	5.4828	5.4465	5.4212	5.3950
util living area	0.9851	0.9718	0.9347	0.8343	0.6703	0.4837	0.3510	0.3914	0.6268	0.8869	0.9712	0.9881 (86)
MIT	20.1725	20.3292	20.5693	20.8239	20.9545	20.9937	20.9991	20.9984	20.9760	20.7879	20.4382	20.1427 (87)
Th 2	20.1713	20.1738	20.1762	20.1875	20.1896	20.1994	20.1994	20.2013	20.1956	20.1896	20.1853	20.1808 (88)
util rest of house	0.9814	0.9651	0.9199	0.8026	0.6214	0.4252	0.2875	0.3241	0.5619	0.8562	0.9633	0.9851 (89)
MIT 2	19.4249	19.5802	19.8125	20.0533	20.1605	20.1965	20.1992	20.2008	20.1830	20.0299	19.6983	19.4035 (90)
Living area fraction												0.2195 (91)
MIT	19.5890	19.7446	19.9786	20.2224	20.3348	20.3715	20.3747	20.3758	20.3571	20.1962	19.8607	19.5657 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5890	19.7446	19.9786	20.2224	20.3348	20.3715	20.3747	20.3758	20.3571	20.1962	19.8607	19.5657 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9782	0.9610	0.9159	0.8041	0.6304	0.4379	0.3015	0.3389	0.5753	0.8565	0.9594	0.9823 (94)
Useful gains	638.8822	702.4893	749.2380	732.6039	609.8416	414.9986	272.8477	286.4560	444.4239	585.8992	604.1746	611.0941 (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	1148.4035	1111.4425	1005.9858	832.4912	633.0865	417.5732	273.1081	286.9450	455.0392	703.5787	940.9523	1139.7903 (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	379.0839	274.8165	191.0204	71.9189	17.2943	0.0000	0.0000	0.0000	0.0000	87.5535	242.4800	393.3500 (98)
Space heating												1657.5175 (98)
Space heating per m2												19.7606 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1837.6026 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	379.0839	274.8165	191.0204	71.9189	17.2943	0.0000	0.0000	0.0000	0.0000	87.5535	242.4800	393.3500	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	420.2704	304.6746	211.7743	79.7327	19.1732	0.0000	0.0000	0.0000	0.0000	97.0660	268.8248	436.0865	(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	97.6153	85.0956	88.3521	79.5072	77.5698	68.4009	65.9676	73.9922	74.3273	84.2411	89.1800	94.6454	(64)
Efficiency of water heater (217)m	86.9827	86.5056	85.3258	82.3865	78.5921	76.4000	76.4000	76.4000	76.4000	82.8608	86.0220	76.4000	(216)
Fuel for water heating, kWh/month	112.2238	98.3700	103.5467	96.5051	98.6992	89.5299	86.3451	96.8484	97.2871	101.6659	103.6712	108.6043	(219)
Water heating fuel used												1193.2966	(219)
Annual totals kWh/year													
Space heating fuel - main system												1837.6026	(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)												368.7228	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 853 * 1.00) =										-900.7996		-900.7996	(233)
Total delivered energy for all uses												2573.8224	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1837.6026	3.4800	63.9486 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1193.2966	3.4800	41.5267 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	368.7228	13.1900	48.6345 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-900.7996	13.1900	-118.8155 (252)
Total energy cost			165.1869 (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] =	0.5383 (257)
SAP value		92.4905
SAP rating (Section 12)		92 (258)
SAP band		A

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	1837.6026	0.2160	396.9222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1193.2966	0.2160	257.7521 (264)
Space and water heating			654.6742 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.7228	0.5190	191.3671 (268)
Energy saving/generation technologies			
PV Unit	-900.7996	0.5190	-467.5150 (269)
Total kg/year			417.4514 (272)
CO2 emissions per m2			4.9800 (273)
EI value			95.6596
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8179 = 4.255$, stars = 5
Water heating environmental impact	$0.216 / 0.8179 = 0.2641$, 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	41.9400 (1b)	x 2.4000 (2b)	= 100.6560 (1b) - (3b)
First floor	41.9400 (1c)	x 2.7000 (2c)	= 113.2380 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.8940 (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					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) = 0.1870 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3870 (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)	=	0.3290 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4194	0.3865	0.3783	0.3536	0.3536	0.3290	0.3290	0.3207	0.3290	0.3701	0.3619	0.3865 (22b)
Effective ac	0.5880	0.5747	0.5716	0.5625	0.5625	0.5541	0.5541	0.5514	0.5541	0.5685	0.5655	0.5747 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Fully Glazed Door/Win (Uw = 1.20)			14.3600	1.1450	16.4427		(27)
Heat Loss Floor 1			41.9400	0.1200	5.0328	75.0000	3145.5000 (28a)
External Wall 1	49.9800	16.4800	33.5000	0.1800	6.0300	43.4900	1456.9150 (29a)
External Roof 1	41.9400		41.9400	0.0900	3.7746	10.3700	434.9178 (30)
Total net area of external elements Aum(A, m ²)			133.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.6121		(33)
Party Wall 1			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Party Wall 2			45.0000	0.0000	0.0000	110.0000	4950.0000 (32)
Internal Wall 1			54.1900			9.0000	487.7100 (32c)
Internal Wall 2			74.4000			9.0000	669.6000 (32c)
Internal Floor 1			41.9400			18.0000	754.9200 (32d)
Internal Ceiling 1			41.9400			18.0000	754.9200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17604.4828 (34)
209.8770 (35)
0.0000 (36)
(33) + (36) = 33.6121 (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	41.5009	40.5653	40.3433	39.7060	39.7060	39.1116	39.1116	38.9230	39.1116	40.1261	39.9136	40.5653 (38)
Heat transfer coeff	75.1131	74.1774	73.9554	73.3181	73.3181	72.7238	72.7238	72.5352	72.7238	73.7382	73.5258	74.1774 (39)
Average = Sum(39)m / 12 =												73.5025 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8955	0.8843	0.8817	0.8741	0.8741	0.8670	0.8670	0.8647	0.8670	0.8791	0.8766	0.8843 (40)
HLP (average)												0.8763 (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
Average daily hot water use (litres/day)
2.5324 (42)
94.3438 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.7782	100.0044	96.2307	92.4569	88.6832	84.9094	84.9094	88.6832	92.4569	96.2307	100.0044	103.7782 (44)
Energy conte	153.9001	134.6020	138.8972	121.0939	116.1925	100.2653	92.9105	106.6162	107.8895	125.7349	137.2494	149.0440 (45)

Energy content (annual)											Total = Sum(45)m =		1484.3955 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.0850	20.1903	20.8346	18.1641	17.4289	15.0398	13.9366	15.9924	16.1834	18.8602	20.5874	22.3566 (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	0.6705	0.6057	0.6015	0.5038	0.4637	0.3831	0.3550	0.4255	0.4489	0.5445	0.6176	0.6494 (61)	
Total heat required for water heating calculated for each month													
	154.5706	135.2077	139.4987	121.5977	116.6562	100.6484	93.2655	107.0417	108.3384	126.2793	137.8670	149.6934 (62)	
WWHRS	-56.9553	-50.1121	-51.1466	-42.0906	-39.0864	-32.2476	-27.2979	-33.0495	-34.0111	-42.0382	-48.6870	-55.0479 eq. (G10)	
Total of WWHRS savings													
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 (64)
Output from w/h	97.6153	85.0956	88.3521	79.5072	77.5698	68.4009	65.9676	73.9922	74.3273	84.2411	89.1800	94.6454 (64)	
								Total per year (kWh/year) = Sum(64)m =					978.8944 (64)
Heat gains from water heating, kWh/month													
	51.3394	44.9066	46.3337	40.3897	38.7499	33.4340	30.9815	35.5563	35.9855	41.9430	45.7898	49.7195 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423	151.9423 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1965	46.3605	37.7029	28.5435	21.3366	18.0133	19.4640	25.3000	33.9576	43.1170	50.3239	53.6472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.3408	342.8621	333.9885	315.0978	291.2516	268.8396	253.8670	250.3457	259.2192	278.1099	301.9561	324.3681 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266	52.7266 (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)	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948	-101.2948 (71)
Water heating gains (Table 5)	69.0046	66.8253	62.2765	56.0968	52.0832	46.4361	41.6418	47.7907	49.9798	56.3749	63.5970	66.8272 (72)
Total internal gains	566.9159	562.4218	540.3419	506.1121	471.0455	439.6629	421.3467	429.8103	449.5307	483.9759	522.2510	551.2166 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
East				4.1100	25.9136	0.6300		0.7000	0.7700		32.5493	
West				10.2500	25.9136	0.6300		0.7000	0.7700		(76)	
Solar gains	113.7247	189.9673	310.0918	458.1464	534.4609	591.3705	549.8120	483.5816	381.6153	238.1553	140.4919	89.3001
Total gains	680.6406	752.3891	850.4337	964.2585	1005.5064	1031.0334	971.1587	913.3919	831.1460	722.1312	662.7429	640.5167

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.1036	65.9248	66.1227	66.6975	66.6975	67.2426	67.2426	67.4174	67.2426	66.3175	66.5091	65.9248
alpha	5.3402	5.3950	5.4082	5.4465	5.4465	5.4828	5.4828	5.4945	5.4828	5.4212	5.4339	5.3950
util living area	0.9762	0.9605	0.9076	0.7788	0.5953	0.3935	0.2769	0.2936	0.5176	0.8167	0.9478	0.9807 (86)
MIT	20.3130	20.4403	20.6722	20.8845	20.9765	20.9979	20.9998	20.9997	20.9916	20.8796	20.5944	20.2919 (87)
Th 2	20.1713	20.1808	20.1831	20.1896	20.1896	20.1956	20.1956	20.1976	20.1956	20.1853	20.1875	20.1808 (88)
util rest of house	0.9702	0.9511	0.8877	0.7412	0.5433	0.3377	0.2168	0.2300	0.4513	0.7721	0.9334	0.9757 (89)
MIT 2	19.5631	19.6941	19.9143	20.1056	20.1758	20.1948	20.1956	20.1975	20.1919	20.1027	19.8501	19.5509 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.2195 (91)
MIT	19.7277	19.8579	20.0807	20.2765	20.3515	20.3711	20.3721	20.3736	20.3674	20.2732	20.0134	19.7135 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7277	19.8579	20.0807	20.2765	20.3515	20.3711	20.3721	20.3736	20.3674	20.2732	20.0134	19.7135 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9663	0.9468	0.8849	0.7454	0.5539	0.3499	0.2300	0.2440	0.4657	0.7773	0.9298	0.9722 (94)
Useful gains	657.7252	712.3431	752.5356	718.7662	556.9934	360.7650	223.3596	222.8688	387.0305	561.3337	616.1918	622.6945 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	1076.1950	1050.1931	945.1986	782.7830	568.3286	361.5160	223.4141	222.9415	390.3388	624.8019	853.8878	1054.3201 (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	311.3415	227.0352	143.3413	46.0921	8.4333	0.0000	0.0000	0.0000	0.0000	47.2204	171.1411	321.1295 (98)
Space heating												1275.7343 (98)
Space heating per m2												15.2090 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1414.3396 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	311.3415	227.0352	143.3413	46.0921	8.4333	0.0000	0.0000	0.0000	0.0000	47.2204	171.1411	321.1295	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	345.1680	251.7020	158.9149	51.0999	9.3496	0.0000	0.0000	0.0000	0.0000	52.3507	189.7351	356.0194	(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	97.6153	85.0956	88.3521	79.5072	77.5698	68.4009	65.9676	73.9922	74.3273	84.2411	89.1800	94.6454	(64)
Efficiency of water heater (217)m	86.4718	85.9666	84.3874	80.9446	77.5636	76.4000	76.4000	76.4000	76.4000	80.8427	84.9438	76.4000	(216)
Fuel for water heating, kWh/month	112.8869	98.9868	104.6981	98.2241	100.0079	89.5299	86.3451	96.8484	97.2871	104.2038	104.9871	109.2428	(219)
Water heating fuel used												1203.2480	(219)
Annual totals kWh/year													
Space heating fuel - main system												1414.3396	(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)												368.7228	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 989 * 1.00) =										-1043.9974		-1043.9974	(233)
Total delivered energy for all uses												2017.3129	(238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1414.3396	6.3300	89.5277 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1203.2480	6.3300	76.1656 (247)
Pumps and fans for heating	75.0000	26.0600	19.5450 (249)
Energy for lighting	368.7228	26.0600	96.0892 (250)
Additional standing charges			113.0000 (251)
Energy saving/generation technologies			
PV Unit	-1043.9974	26.0600	-272.0657 (252)
Total energy cost			122.2617 (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	1414.3396	0.2160	305.4974 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1203.2480	0.2160	259.9016 (264)
Space and water heating			565.3989 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.7228	0.5190	191.3671 (268)
Energy saving/generation technologies			
PV Unit	-1043.9974	0.5190	-541.8347 (269)
Total kg/year			253.8564 (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	1414.3396	1.2200	1725.4943 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1203.2480	1.2200	1467.9625 (264)
Space and water heating			3193.4568 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	368.7228	3.0700	1131.9789 (268)
Energy saving/generation technologies			
PV Unit	-1043.9974	3.0700	-3205.0721 (269)
Primary energy kWh/year			1350.6137 (272)
Primary energy kWh/m2/year			16.1017 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
Current environmental impact rating: A 96

(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	SAP increase too small
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
(none)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 36 -140 kg (55.0%)

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

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
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	£116	£116	£0
Mains gas	£279	£279	£0
Space heating	£222	£222	£0
Water heating	£76	£76	£0
Lighting	£96	£96	£0
Generated (PV)	-£272	-£272	£0
Total cost of fuels	£123	£123	£0
Total cost of uses	£122	£122	£0
Delivered energy	24 kWh/m²	24 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	16 kWh/m²	16 kWh/m²	0 kWh/m²

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