

FULL SAP CALCULATION PRINTOUT

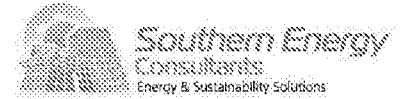
Calculation Type: New Build (As Designed)



Property Reference	SECANG011b			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br CI Ea Ga		
Property	Longthopre, Plot 42				
SAP Rating	83 B	DER	18.27	TER	18.88
Environmental	84 B	% DER<TER	3.21		
CO ₂ Emissions (t/year)	1.64	DFEE	57.50	TFEE	62.25
General Requirements Compliance	Pass	% DFEE<TFEE	7.64		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 107 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.88 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.27 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 57.5 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.41 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.60 (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: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Time and temperature zone control 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 (Thames Valley): Slight OK

Based on:

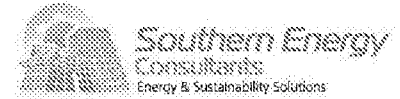
Overshading: Average
Windows facing North: 0.66 m², No overhang
Windows facing East: 9.18 m², No overhang
Windows facing West: 6.61 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K

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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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =		0.3425 (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	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (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	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
Average = Sum(39)m / 12 =												146.2728 (39)
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

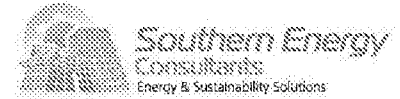
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7932 (42)
Average daily hot water use (litres/day) 100.5390 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (65)
								Total per year (kWh/year) =	Sum(64)m =			1747.5516 (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	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661 (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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288 (71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336 (72)
Total internal gains	437.6024	435.2492	419.3002	393.5006	367.0431	341.8325	325.6581	332.2263	345.6709	371.7004	401.5662	424.2139 (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				0.6600	10.6334		0.4400	0.0000	0.7700		2.3777 (74)	
East				9.1800	19.6403		0.4400	0.0000	0.7700		61.0848 (76)	
West				6.6100	19.6403		0.4400	0.0000	0.7700		43.9837 (80)	

Solar gains	107.4463	210.0804	346.2105	506.0686	621.7137	637.2173	606.3275	519.7308	402.9604	249.2952	133.9414	88.3855 (83)
Total gains	545.0487	645.3296	765.5106	899.5692	988.7567	979.0498	931.9856	851.9571	748.6313	620.9957	535.5076	512.5993 (84)

7. Mean internal temperature (heating season)

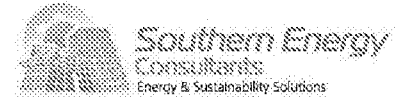
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6856	30.7518	30.8170	31.1269	31.1856	31.4617	31.4617	31.5134	31.3548	31.1856	31.0671	30.9442
alpha	3.0457	3.0501	3.0545	3.0751	3.0790	3.0974	3.0974	3.1009	3.0903	3.0790	3.0711	3.0629
util living area	0.9922	0.9864	0.9718	0.9345	0.8590	0.7346	0.5990	0.6558	0.8525	0.9613	0.9878	0.9936 (86)
MIT	18.6930	18.9176	19.3322	19.8878	20.3911	20.7514	20.9058	20.8727	20.5636	19.8966	19.1962	18.6559 (87)
Th 2	19.7701	19.7724	19.7747	19.7853	19.7873	19.7966	19.7966	19.7983	19.7930	19.7873	19.7833	19.7791 (88)
util rest of house	0.9904	0.9832	0.9648	0.9167	0.8172	0.6491	0.4661	0.5269	0.7916	0.9476	0.9843	0.9921 (89)
MIT 2	16.7077	17.0361	17.6387	18.4398	19.1336	19.5915	19.7470	19.7243	19.3817	18.4668	17.4505	16.6587 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	16.9380	17.2543	17.8351	18.6078	19.2794	19.7260	19.8814	19.8575	19.5188	18.6326	17.6530	16.8903 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7880	17.1043	17.6851	18.4578	19.1294	19.5760	19.7314	19.7075	19.3688	18.4826	17.5030	16.7403 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9829	0.9718	0.9465	0.8898	0.7886	0.6306	0.4580	0.5157	0.7637	0.9251	0.9735	0.9856 (94)
Ext temp.	535.7233	627.1008	724.5335	800.4739	779.7327	617.3877	426.8433	439.3393	571.7071	574.4559	521.3327	505.2365 (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	1852.9404	1806.9483	1652.5467	1398.0533	1084.6875	720.1184	453.1628	477.8666	765.0854	1150.8472	1524.6151	1845.1530 (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 (98a)
Space heating	980.0095	792.8575	690.4418	430.2572	226.8863	0.0000	0.0000	0.0000	0.0000	428.8351	722.3633	996.8979 (98)
Space heating per m2										(98) / (4) =		49.3957 (99)

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Calculation Type: New Build (As Designed)



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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5821.6008	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	980.0095	792.8575	690.4418	430.2572	226.8863	0.0000	0.0000	0.0000	0.0000	428.8351	722.3633	996.8979	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	1082.8834	876.0857	762.9192	475.4223	250.7031	0.0000	0.0000	0.0000	0.0000	473.8510	798.1915	1101.5446	(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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)	
Efficiency of water heater (217)m	89.9926	89.9573	89.8735	89.6814	89.2633	87.3000	87.3000	87.3000	87.3000	89.6565	89.9027	90.0122	(217)	
Fuel for water heating, kWh/month	197.9677	173.6494	180.3977	159.0782	154.4417	137.9085	129.4194	146.1988	147.2610	165.1520	177.8878	192.1616	(219)	
Water heating fuel used												1961.5238	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5821.6008	(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)													441.2701	(232)
Total delivered energy for all uses													8299.3947	(238)

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

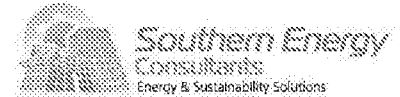
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5821.6008	0.2160	1257.4658	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.5238	0.2160	423.6891	(264)
Space and water heating			1681.1549	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	441.2701	0.5190	229.0192	(268)
Total CO2, kg/year			1949.0991	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2700	(273)

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

DER		18.2700	2C1
Total Floor Area	TFA	106.6600	
Assumed number of occupants	N	2.7932	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.8154	2C2
CO2 emissions from cooking, equation (L16)		1.7442	2C3
Total CO2 emissions		34.8296	2C4
Residual CO2 emissions offset from biofuel CHP		0.0000	2C5
Additional allowable electricity generation, kWh/m²/year		0.0000	2C6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	2C7
Net CO2 emissions		34.8296	2C8

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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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) = 0.3425 (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	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (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 Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			16.4500	1.3258	21.8087		(27)
Heat Loss Floor 1			45.7700	0.1300	5.9501		(28a)
Exposed Floor Over Garage			18.4800	0.1300	2.4024		(28b)
Brick Cavity	127.2500	16.4800	110.7700	0.1800	19.9386		(29a)
Solid Garage Wall	19.5500		19.5500	0.1800	3.5190		(29a)
Clad Cavity	12.0600	2.1200	9.9400	0.1800	1.7892		(29a)
Main Plane	60.8900		60.8900	0.1300	7.9157		(30)
Porch Roof	4.7800		4.7800	0.1300	0.6214		(30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5251		(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)							17.9154 (36)
Total fabric heat loss							(33) + (36) = 84.4405 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Average = Sum(39)m / 12 =	135.8094	135.4898	135.1766	133.7056	133.4303	132.1490	132.1490	131.9118	132.6426	133.4303	133.9871	134.5692 (39)
												133.7042 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2733	1.2703	1.2674	1.2536	1.2510	1.2390	1.2390	1.2368	1.2436	1.2510	1.2562	1.2617 (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)												2.7932 (42)
												100.5390 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	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	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.5892	48.1595	44.6228	46.1102	48.1595	48.5892	50.9589	49.3151	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	214.9649	189.4681	198.9769	177.6349	171.9819	151.4721	145.1218	161.7768	163.5634	184.9502	195.5771	209.7900	209.7900	(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	0.0000	(63)
Output from w/h	214.9649	189.4681	198.9769	177.6349	171.9819	151.4721	145.1218	161.7768	163.5634	184.9502	195.5771	209.7900	209.7900	(64)
Heat gains from water heating, kWh/month	67.2717	59.2009	61.9557	55.0550	53.2108	46.6831	44.4489	49.8176	50.3762	57.2918	60.9609	65.5511	65.5511	(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	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	(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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	90.4190	88.0966	83.2738	76.4653	71.5199	64.8376	59.7432	66.9592	69.9670	77.0052	84.6679	88.1063	(72)
Total internal gains	449.9709	447.6219	431.6816	405.6434	378.5089	352.6234	336.4573	343.6999	357.8253	384.0932	413.9451	436.5866	(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				0.6600	10.6334		0.6300		0.7000		0.7700		2.1448 (74)
East				9.1800	19.6403		0.6300		0.7000		0.7700		55.1013 (76)
West				6.6100	19.6403		0.6300		0.7000		0.7700		39.6753 (80)
Solar gains	96.9214	189.5020	312.2976	456.4969	560.8140	574.7990	546.9350	468.8208	363.4886	224.8756	120.8212	79.7277	(83)
Total gains	546.8923	637.1240	743.9792	862.1403	939.3228	927.4224	883.3923	812.5207	721.3139	608.9688	534.7663	516.3143	(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	54.5393	54.6679	54.7946	55.3974	55.5117	56.0499	56.0499	56.1507	55.8414	55.5117	55.2810	55.0419	
alpha	4.6360	4.6445	4.6530	4.6932	4.7008	4.7367	4.7367	4.7434	4.7228	4.7008	4.6854	4.6695	
util living area	0.9990	0.9977	0.9931	0.9750	0.9175	0.7856	0.6241	0.6886	0.9075	0.9882	0.9979	0.9992 (86)	
MIT	19.5173	19.6681	19.9472	20.3283	20.6722	20.8985	20.9739	20.9590	20.7743	20.3205	19.8522	19.4943 (87)	
Th 2	19.8618	19.8642	19.8665	19.8774	19.8794	19.8889	19.8889	19.8907	19.8853	19.8794	19.8753	19.8710 (88)	
util rest of house	0.9986	0.9968	0.9905	0.9643	0.8803	0.6930	0.4832	0.5494	0.8498	0.9816	0.9970	0.9989 (89)	
MIT 2	17.8849	18.1070	18.5155	19.0719	19.5445	19.8176	19.8790	19.8729	19.6895	19.0685	18.3842	17.8574 (90)	
Living area fraction									fLA = Living area / (4) =				0.1160 (91)
MIT	18.0742	18.2880	18.6816	19.2176	19.6753	19.9430	20.0060	19.9989	19.8153	19.2137	18.5545	18.0473 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.0742	18.2880	18.6816	19.2176	19.6753	19.9430	20.0060	19.9989	19.8153	19.2137	18.5545	18.0473 (93)	

8. Space heating requirement

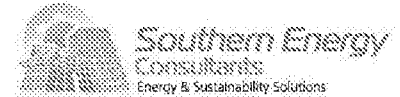
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9976	0.9950	0.9862	0.9556	0.8718	0.6982	0.4990	0.5644	0.8451	0.9756	0.9953	0.9882 (94)
Useful gains	545.5978	633.9101	733.7484	823.9002	818.9045	647.5056	440.8545	458.5692	609.6020	594.1124	532.2667	515.3820 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1870.6709	1813.9429	1646.6613	1379.5196	1064.1405	706.0709	450.1016	474.7321	758.0916	1149.3240	1534.7542	1863.4173 (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	985.8543	792.9820	679.2072	400.0459	182.4556	0.0000	0.0000	0.0000	0.0000	413.0774	721.7910	1002.9383 (98)
Space heating												5178.3518 (98)
Space heating per m2										(98) / (4) =		48.5501 (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

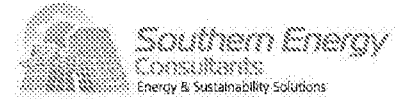
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5544.2739 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	985.8543	792.9820	679.2072	400.0459	182.4556	0.0000	0.0000	0.0000	0.0000	413.0774	721.7910	1002.9383	(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)	1055.5186	849.0171	727.2025	428.3147	195.3486	0.0000	0.0000	0.0000	0.0000	442.2671	772.7955	1073.8098	(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	214.9649	189.4681	198.9769	177.6349	171.9819	151.4721	145.1218	161.7768	163.5634	184.9502	195.5771	209.7900	(64)
Efficiency of water heater (217)m	88.4094	88.2591	87.8951	87.0338	85.2002	80.3000	80.3000	80.3000	80.3000	87.0152	88.0392	88.4749	(216)
Fuel for water heating, kWh/month	243.1473	214.6726	226.3799	204.0987	201.8563	188.6327	180.7245	201.4655	203.6905	212.5494	222.1477	237.1180	(219)
Water heating fuel used												2536.4831	(219)
Annual totals kWh/year													
Space heating fuel - main system												5544.2739	(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)												441.2701	(232)
Total delivered energy for all uses												8597.0271	(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	5544.2739	0.2160	1197.5632 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2536.4831	0.2160	547.8804 (264)
Space and water heating			1745.4435 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total CO2, kg/m2/year			2013.3877 (272)
Emissions per m2 for space and water heating			16.3646 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1472 (272b)
Emissions per m2 for pumps and fans			0.3649 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3646 * 1.00) + 2.1472 + 0.3649, rounded to 2 d.p.			18.8800 (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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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)	=	0.3425 (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	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			9.0000	370.1700 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16020.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.2048 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (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	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
Average = Sum(39)m / 12 =												146.2728 (39)
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

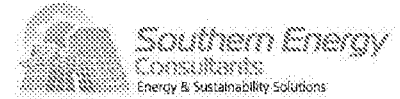
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7932 (42)
Average daily hot water use (litres/day) 100.5390 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
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	34.8513	30.4812	31.4538	27.4222	26.3123	22.7055	21.0400	24.1437	24.4320	28.4732	31.0807	33.7516 (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	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	(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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	46.8431	45.3589	42.2766	38.0864	35.3659	31.5354	28.2795	32.4512	33.9334	38.2704	43.1676	45.3651	(72)
Total internal gains	403.3950	401.8842	387.6844	364.2645	339.3549	316.3212	301.9937	306.1919	318.7917	342.3584	369.4448	390.8454	(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					0.6600	10.6334	0.4400	0.0000	0.7700	2.3777 (74)		
East					9.1800	19.6403	0.4400	0.0000	0.7700	61.0848 (76)		
West					6.6100	19.6403	0.4400	0.0000	0.7700	43.9837 (80)		
Solar gains	107.4463	210.0804	346.2105	506.0686	621.7137	637.2173	606.3275	519.7308	402.9604	249.2952	133.9414	88.3855 (83)
Total gains	510.8413	611.9646	733.8949	870.3331	961.0685	953.5385	908.3212	825.9227	721.7521	591.6536	503.3862	479.2308 (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	29.9926	30.0573	30.1210	30.4239	30.4813	30.7512	30.7512	30.8017	30.6466	30.4813	30.3655	30.2454	
alpha	2.9995	3.0038	3.0081	3.0283	3.0321	3.0501	3.0501	3.0534	3.0431	3.0321	3.0244	3.0164	
util living area	0.9930	0.9874	0.9734	0.9372	0.8637	0.7420	0.6080	0.6664	0.8597	0.9642	0.9890	0.9943	(86)
MIT	18.6177	18.8472	19.2712	19.8406	20.3584	20.7334	20.8970	20.8607	20.5354	19.8476	19.1311	18.5807	(87)
Th 2	19.7701	19.7724	19.7747	19.7853	19.7873	19.7966	19.7966	19.7983	19.7930	19.7873	19.7833	19.7791	(88)
util rest of house	0.9914	0.9845	0.9668	0.9202	0.8233	0.6579	0.4752	0.5384	0.8012	0.9515	0.9859	0.9929	(89)
MIT 2	17.6074	17.8373	18.2592	18.8239	19.3138	19.6445	19.7588	19.7418	19.4904	18.8410	18.1290	17.5768	(90)
Living area fraction	17.7246	17.9544	18.3766	18.9418	19.4349	19.7708	19.8908	19.8716	19.6116	18.9578	18.2453	17.6932	(91)
MIT	17.7246	17.9544	18.3766	18.9418	19.4349	19.7708	19.8908	19.8716	19.6116	18.9578	18.2453	17.6932	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7246	17.9544	18.3766	18.9418	19.4349	19.7708	19.8908	19.8716	19.6116	18.9578	18.2453	17.6932	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9874	0.9782	0.9564	0.9049	0.8090	0.6558	0.4868	0.5473	0.7901	0.9394	0.9801	0.9895	(94)
Useful gains	504.4023	598.6153	701.9053	787.5932	777.4711	625.3190	442.1279	452.0624	570.2543	555.7706	493.3934	474.2186	(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	1991.9106	1932.8164	1754.7080	1468.8571	1129.2914	748.3044	476.2357	501.5756	800.3478	1220.2246	1633.4013	1985.3588	(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	1106.7061	896.5831	783.2853	490.5101	261.7543	0.0000	0.0000	0.0000	0.0000	494.3538	820.8057	1124.2883	(98)
Space heating												5978.2866	(98)
Space heating per m ²												(98) / (4) =	56.0499 (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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

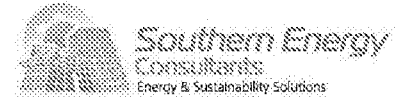


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1360.3451	1070.9099	1098.0502	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7119	0.7849	0.7450	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	968.4097	840.5302	818.0282	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1223.6294	1168.4434	1074.2523	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	183.7582	243.9675	190.6307	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												618.3563	(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	45.9395	60.9919	47.6577	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												154.5891	(107)
Space cooling per m2												1.4494	(108)
Energy for space heating												56.0499	(99)
Energy for space cooling												1.4494	(108)
Total												57.4993	(109)
Dwelling Fabric Energy Efficiency (DFEE)												57.5	(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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =		0.3425 (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	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (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 Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			16.4500	1.3258	21.8087		(27)
Heat Loss Floor 1			45.7700	0.1300	5.9501		(28a)
Exposed Floor Over Garage			18.4800	0.1300	2.4024		(28b)
Brick Cavity	127.2500	16.4800	110.7700	0.1800	19.9386		(29a)
Solid Garage Wall	19.5500		19.5500	0.1800	3.5190		(29a)
Clad Cavity	12.0600	2.1200	9.9400	0.1800	1.7892		(29a)
Main Plane	60.8900		60.8900	0.1300	7.9157		(30)
Porch Roof	4.7800		4.7800	0.1300	0.6214		(30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5251		(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)							17.9154 (36)
Total fabric heat loss						(33) + (36) =	84.4405 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Average = Sum(39)m / 12 =	135.8094	135.4898	135.1766	133.7056	133.4303	132.1490	132.1490	131.9118	132.6426	133.4303	133.9871	134.5692 (39)
												133.7042 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2733	1.2703	1.2674	1.2536	1.2510	1.2390	1.2390	1.2368	1.2436	1.2510	1.2562	1.2617 (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												2.7932 (42)
Average daily hot water use (litres/day)												100.5390 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.8513	30.4812	31.4538	27.4222	26.3123	22.7055	21.0400	24.1437	24.4320	28.4732	31.0807	33.7516	(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	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	(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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	46.8431	45.3589	42.2766	38.0864	35.3659	31.5354	28.2795	32.4512	33.9334	38.2704	43.1676	45.3651	(72)
Total internal gains	403.3950	401.8842	387.6844	364.2645	339.3549	316.3212	301.9937	306.1919	318.7917	342.3584	369.4448	390.8454	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
North	0.6600	10.6334	0.6300	0.7000	0.7700	2.1448 (74)
East	9.1800	19.6403	0.6300	0.7000	0.7700	55.1013 (76)
West	6.6100	19.6403	0.6300	0.7000	0.7700	39.6753 (80)

Solar gains	96.9214	189.5020	312.2976	456.4969	560.8140	574.7990	546.9350	468.8208	363.4886	224.8756	120.8212	79.7277	(83)
Total gains	500.3165	591.3863	699.9820	820.7614	900.1688	891.1202	848.9287	775.0127	682.2803	567.2340	490.2660	470.5731	(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	54.5393	54.6679	54.7946	55.3974	55.5117	56.0499	56.0499	56.1507	55.8414	55.5117	55.2810	55.0419	
alpha	4.6360	4.6445	4.6530	4.6932	4.7008	4.7367	4.7367	4.7434	4.7228	4.7008	4.6854	4.6695	
util living area	0.9993	0.9983	0.9946	0.9792	0.9277	0.8034	0.6444	0.7124	0.9219	0.9911	0.9986	0.9995	(86)
MIT	19.4774	19.6291	19.9105	20.2964	20.6491	20.8875	20.9702	20.9526	20.7522	20.2863	19.8141	19.4549	(87)
Th 2	19.8618	19.8642	19.8665	19.8774	19.8794	19.8889	19.8889	19.8907	19.8853	19.8794	19.8753	19.8710	(88)
util rest of house	0.9990	0.9977	0.9925	0.9701	0.8937	0.7131	0.5013	0.5727	0.8700	0.9860	0.9980	0.9993	(89)
MIT 2	18.4722	18.6256	18.9078	19.2970	19.6314	19.8340	19.8811	19.8763	19.7348	19.2925	18.8193	18.4569	(90)
Living area fraction									fLA = Living area / (4) =			0.1160	(91)
MIT	18.5888	18.7420	19.0241	19.4129	19.7494	19.9562	20.0074	20.0011	19.8528	19.4077	18.9347	18.5727	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5888	18.7420	19.0241	19.4129	19.7494	19.9562	20.0074	20.0011	19.8528	19.4077	18.9347	18.5727	(93)

8. Space heating requirement

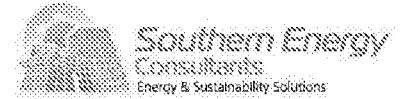
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9968	0.9903	0.9651	0.8888	0.7194	0.5177	0.5882	0.8680	0.9829	0.9972	0.9990	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1940.5515	1875.4469	1692.9611	1405.6394	1074.0345	707.8117	450.2813	475.0284	763.0668	1175.2195	1585.6973	1934.1201	(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	1072.0506	864.1692	743.8256	441.7632	203.8426	0.0000	0.0000	0.0000	0.0000	459.5667	789.7085	1089.2395	(98)
Space heating												5664.1660	(98)
Space heating per m ²												53.1049	(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	1242.2010	977.9029	1002.5294	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7927	0.8702	0.8309	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	984.6407	850.9354	832.9521	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1150.6729	1099.0236	1014.7471	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

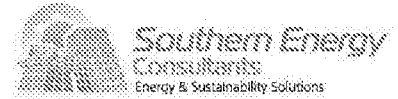


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	119.5432	184.5776	135.2554	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												439.3763 (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	29.8858	46.1444	33.8139	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												109.8441 (107)
Space cooling per m2												1.0299 (108)
Energy for space heating												53.1049 (99)
Energy for space cooling												1.0299 (108)
Total												54.1347 (109)
Target Fabric Energy Efficiency (TFEE)												62.3 (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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3597	0.3425	0.3425	0.3169	0.3169	0.2826	0.2912	0.2740	0.2826	0.2997	0.2997	0.3254 (22b)
Effective ac	0.5647	0.5587	0.5587	0.5502	0.5502	0.5399	0.5424	0.5375	0.5399	0.5449	0.5449	0.5529 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7209	48.2021	48.2021	47.4713	47.4713	46.5854	46.7974	46.3798	46.5854	47.0157	47.0157	47.7085 (38)
Heat transfer coeff	145.7299	145.2111	145.2111	144.4803	144.4803	143.5945	143.8064	143.3888	143.5945	144.0247	144.0247	144.7176 (39)
Average = Sum(39)m / 12 =												144.3553 (39)
HLP	1.3663	1.3614	1.3614	1.3546	1.3546	1.3463	1.3483	1.3444	1.3463	1.3503	1.3503	1.3568 (40)
HLP (average)												1.3534 (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 2.7932 (42)
Average daily hot water use (litres/day) 100.5390 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Regs Region: England

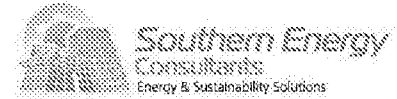
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
Water storage loss:	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (64)
RHI water heating demand												1747.5516 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (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	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525 (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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288 (71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336 (72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023 (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				0.6600	11.9814	0.4400	0.0000	0.7700	2.6791 (74)			
East				9.1800	22.3313	0.4400	0.0000	0.7700	69.4545 (76)			
West				6.6100	22.3313	0.4400	0.0000	0.7700	50.0103 (80)			
Solar gains	122.1439	214.8637	349.2353	524.6946	626.7549	686.9382	646.7756	567.7986	440.1563	272.1220	155.9962	99.4952 (83)
Total gains	774.0882	861.6272	970.3986	1106.1696	1167.3677	1191.2794	1130.1889	1060.6078	956.0613	827.9451	756.0898	733.2975 (84)

7. Mean internal temperature (heating season)

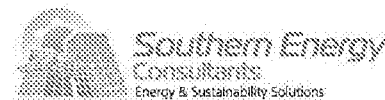
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.2431	31.3548	31.3548	31.5134	31.5134	31.7078	31.6610	31.7532	31.7078	31.6130	31.6130	31.4617
alpha	3.0829	3.0903	3.0903	3.1009	3.1009	3.1139	3.1107	3.1169	3.1139	3.1075	3.1075	3.0974
util living area	0.9771	0.9671	0.9401	0.8746	0.7524	0.5462	0.3809	0.4140	0.7024	0.9028	0.9635	0.9801 (86)
MIT	19.1297	19.3168	19.7252	20.2353	20.6665	20.9189	20.9816	20.9762	20.8058	20.2705	19.6239	19.0994 (87)
Th 2	19.7893	19.7930	19.7930	19.7983	19.7983	19.8048	19.8032	19.8063	19.8048	19.8016	19.8016	19.7966 (88)
util rest of house	0.9718	0.9596	0.9257	0.8432	0.6875	0.4358	0.2399	0.2678	0.6049	0.8709	0.9535	0.9755 (89)
MIT 2	17.3525	17.6243	18.2093	18.9227	19.4820	19.7568	19.7988	19.7999	19.6586	18.9907	18.0770	17.3134 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	17.5586	17.8206	18.3851	19.0750	19.6194	19.8915	19.9359	19.9363	19.7916	19.1392	18.2564	17.5205 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4086	17.6706	18.2351	18.9250	19.4694	19.7415	19.7859	19.7863	19.6416	18.9892	18.1064	17.3705 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9560	0.9401	0.9001	0.8144	0.6668	0.4294	0.2378	0.2653	0.5895	0.8418	0.9327	0.9610 (94)
Ext temp.	739.9992	809.9942	873.4437	900.8266	778.3545	511.5822	268.7723	281.3397	563.5609	697.0035	705.1727	704.7243 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1793.7335	1752.7786	1573.3777	1303.9283	934.6974	537.2651	271.2112	284.8149	637.7960	1064.2207	1455.5693	1775.7597 (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	783.9783	633.5511	520.7509	290.2332	116.3191	0.0000	0.0000	0.0000	0.0000	273.2096	540.2855	796.8503 (98)
RHI space heating demand												3955.1782 (98)

FULL SAP CALCULATION PRINTOUT

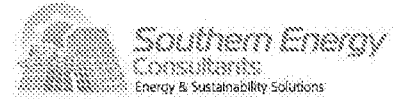
Calculation Type: New Build (As Designed)



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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =		0.3425 (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	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Average = Sum(39)m / 12 =	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (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												2.7932 (42)
Average daily hot water use (litres/day)												100.5390 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Southern Energy
Consultants
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Energy conte	110.5929	106.5713	122.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929	(44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311	(45)
Distribution loss	(46)m =	0.15 x	(45)m							Total = Sum(45)m =		1581.8696	(45)
Water storage loss:	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378	(61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525 (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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288 (71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336 (72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023 (73)

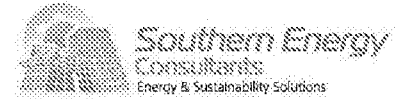
[Jan	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6600	10.6334	0.4400	0.0000	0.7700	2.3777 (74)
East	9.1800	19.6403	0.4400	0.0000	0.7700	61.0848 (76)
West	6.6100	19.6403	0.4400	0.0000	0.7700	43.9837 (80)



ARUN DISTRICT COUNCIL A/38/21/DOC

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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5089.2311	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	872.2735	701.4148	603.2068	366.6348	185.6158	0.0000	0.0000	0.0000	0.0000	356.6682	630.0115	889.9287	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	963.8381	775.0440	666.5268	405.1214	205.1003	0.0000	0.0000	0.0000	0.0000	394.1085	696.1453	983.3466	(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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)	
Efficiency of water heater (217)m	89.9409	89.8998	89.8027	89.5802	89.1080	87.3000	87.3000	87.3000	87.3000	89.5372	89.8333	89.9634	(216)	
Fuel for water heating, kWh/month	198.0815	173.7604	180.5400	159.2580	154.7110	137.9085	129.4194	146.1988	147.2610	165.3720	178.0250	192.2659	(217)	
Water heating fuel used												1962.8016	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5089.2311	(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)												441.2701	(232)	
Total delivered energy for all uses												7568.3028	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5089.2311	3.4800	177.1052 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1962.8016	3.4800	68.3055 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	441.2701	13.1900	58.2035 (250)
Additional standing charges			120.0000 (251)
Total energy cost			433.5068 (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] = 1.2005 (257)
SAP value	83.2526
SAP rating (Section 12)	B (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5089.2311	0.2160	1099.2739 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1962.8016	0.2160	423.9652 (264)
Space and water heating			1523.2391 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total kg/year			1791.1832 (272)
CO2 emissions per m2			16.7900 (273)
EI value			84.1739
EI rating			B (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8891 = 3.914$, stars = 4
Water heating environmental impact	$0.216 / 0.8891 = 0.2430$, stars = 4

Regs Region: England

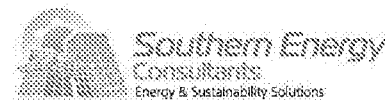
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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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	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =				0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3597	0.3425	0.3425	0.3169	0.3169	0.2826	0.2912	0.2740	0.2826	0.2997	0.2997	0.3254 (22b)
Effective ac	0.5647	0.5587	0.5587	0.5502	0.5502	0.5399	0.5424	0.5375	0.5399	0.5449	0.5449	0.5529 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7209	48.2021	48.2021	47.4713	47.4713	46.5854	46.7974	46.3798	46.5854	47.0157	47.0157	47.7085 (38)
Heat transfer coeff	145.7299	145.2111	145.2111	144.4803	144.4803	143.5945	143.8064	143.3888	143.5945	144.0247	144.0247	144.7176 (39)
Average = Sum(39)m / 12 =												144.3553 (39)
HLP	1.3663	1.3614	1.3614	1.3546	1.3546	1.3463	1.3483	1.3444	1.3463	1.3503	1.3503	1.3568 (40)
HLP (average)												1.3534 (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 2.7932 (42)
Average daily hot water use (litres/day) 100.5390 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Regs Region: England

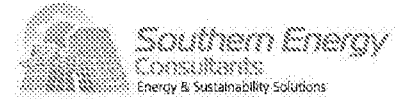
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (65)
								Total per year (kWh/year) =	Sum(64)m =			1747.5516 (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	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525 (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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288 (71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336 (72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023 (73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF	Access		Gains	
				m2	Table 6a	Specific data	or Table 6b	Specific data	or Table 6c	factor	W	
					W/m2					Table 6d		
North				0.6600	11.9814		0.4400	0.0000		0.7700	2.6791 (74)	
East				9.1800	22.3313		0.4400	0.0000		0.7700	69.4545 (76)	
West				6.6100	22.3313		0.4400	0.0000		0.7700	50.0103 (80)	

Solar gains	122.1439	214.8637	349.2353	524.6946	626.7549	686.9382	646.7756	567.7986	440.1563	272.1220	155.9962	99.4952 (83)
Total gains	774.0882	861.6272	970.3986	1106.1696	1167.3677	1191.2794	1130.1889	1060.6078	956.0613	827.9451	756.0898	733.2975 (84)

7. Mean internal temperature (heating season)

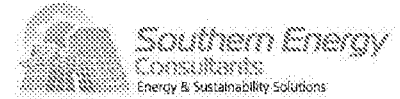
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.2431	31.3548	31.3548	31.5134	31.5134	31.7078	31.6610	31.7532	31.7078	31.6130	31.6130	31.4617
alpha	3.0829	3.0903	3.0903	3.1009	3.1009	3.1139	3.1107	3.1169	3.1139	3.1075	3.1075	3.0974
util living area	0.9771	0.9671	0.9401	0.8746	0.7524	0.5462	0.3809	0.4140	0.7024	0.9028	0.9635	0.9801 (86)
MIT	19.1297	19.3168	19.7252	20.2353	20.6665	20.9189	20.9816	20.9762	20.8058	20.2705	19.6239	19.0994 (87)
Th 2	19.7893	19.7930	19.7930	19.7983	19.7983	19.8048	19.8032	19.8063	19.8048	19.8016	19.8016	19.7966 (88)
util rest of house	0.9718	0.9596	0.9257	0.8432	0.6875	0.4358	0.2399	0.2678	0.6049	0.8709	0.9535	0.9755 (89)
MIT 2	17.3525	17.6243	18.2093	18.9227	19.4820	19.7568	19.7988	19.7999	19.6586	18.9907	18.0770	17.3134 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	17.5586	17.8206	18.3851	19.0750	19.6194	19.8915	19.9359	19.9363	19.7916	19.1392	18.2564	17.5205 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4086	17.6706	18.2351	18.9250	19.4694	19.7415	19.7859	19.7863	19.6416	18.9892	18.1064	17.3705 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9560	0.9401	0.9001	0.8144	0.6668	0.4294	0.2378	0.2653	0.5895	0.8418	0.9327	0.9610 (94)
Useful gains	739.9992	809.9942	873.4437	900.8266	778.3545	511.5822	268.7723	281.3397	563.5609	697.0035	705.1727	704.7243 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1793.7335	1752.7786	1573.3777	1303.9283	934.6974	537.2651	271.2112	284.8149	637.7960	1064.2207	1455.5693	1775.7597 (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	783.9783	633.5511	520.7509	290.2332	116.3191	0.0000	0.0000	0.0000	0.0000	273.2096	540.2855	796.8503 (98)
Space heating												3955.1782 (98)
Space heating per m2										(98) / (4) =		37.0821 (99)

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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4370.3626	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	783.9783	633.5511	520.7509	290.2332	116.3191	0.0000	0.0000	0.0000	0.0000	273.2096	540.2855	796.8503	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	866.2744	700.0565	575.4154	320.6996	128.5294	0.0000	0.0000	0.0000	0.0000	301.8891	597.0006	880.4976	(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	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)	
Efficiency of water heater (217)m	89.8899	89.8486	89.7192	89.4198	88.7359	87.3000	87.3000	87.3000	87.3000	89.3489	89.7486	89.9122	(216)	
Fuel for water heating, kWh/month	198.1938	173.8595	180.7080	159.5436	155.3597	137.9085	129.4194	146.1988	147.2610	165.7206	178.1931	192.3753	(219)	
Water heating fuel used												1964.7414	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4370.3626	(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)													441.2701	(232)
Total delivered energy for all uses													6851.3741	(238)

10a. Fuel costs - using BEDF prices (470)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4370.3626	3.8700	169.1330 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.7414	3.8700	76.0355 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	441.2701	18.9000	83.4000 (250)
Additional standing charges			93.0000 (251)
Total energy cost			435.7436 (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	4370.3626	0.2160	943.9983 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.7414	0.2160	424.3841 (264)
Space and water heating			1368.3825 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total kg/year			1636.3266 (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	4370.3626	1.2200	5331.8424 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.7414	1.2200	2396.9845 (264)
Space and water heating			7728.8269 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	441.2701	3.0700	1354.6992 (268)
Primary energy kWh/year			9313.7760 (272)
Primary energy kWh/m2/year			87.3221 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 83

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 84

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 29	-191 kg (11.6%)
U Solar photovoltaic panels	+ 8.8	-£ 345	-947 kg (65.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	1.79 kg/m²	B 84
Solar photovoltaic panels	£345	8.88 kg/m²	A 93
Total Savings	£374	10.66 kg/m²	A 94

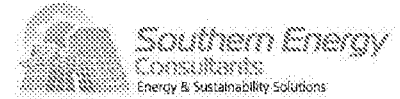
Potential energy efficiency rating: A 93
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
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	£98	£107	-£9
Mains gas	£338	£299	£39
Space heating	£276	£276	£0
Water heating	£76	£47	£29
Lighting	£83	£83	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£436	£61	£375
Total cost of uses	£435	£61	£374
Delivered energy	64 kWh/m²	38 kWh/m²	26 kWh/m²
Carbon dioxide emissions	1.6 tonnes	0.5 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	5 kg/m²	11 kg/m²
Primary energy	87 kWh/m²	25 kWh/m²	63 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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =		0.3425 (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	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (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	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
Average = Sum(39)m / 12 =												146.2728 (39)
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (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 2.7932 (42)
Average daily hot water use (litres/day) 100.5390 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1465 (H8)
Utilisation factor												0.5820 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5390 (H14)
Volume ratio Veff/V												0.7460 (H15)
Solar storage volume factor												0.9414 (H16)
Solar input												-873.6802 (H17)
Solar input	-25.3350	-42.2768	-72.0022	-96.4972	-119.2142	-117.2065	-115.6576	-101.0506	-79.1429	-54.0453	-30.0509	-21.2011 (63)
								Solar input (sum of months) = Sum(63)m =				-873.6802 (63)
Output from w/h	152.8212	113.9335	90.1275	46.1664	18.6456	3.1876	0.0000	26.5809	49.4160	94.0242	129.8749	151.7678 (64)
								Total per year (kWh/year) = Sum(64)m =				876.5457 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (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	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	(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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336	(72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF	Access factor Table 6d	Gains W
North	0.6600	10.6334	0.4400		0.0000	0.7700	2.3777 (74)
East	9.1800	19.6403	0.4400		0.0000	0.7700	61.0848 (76)
West	6.6100	19.6403	0.4400		0.0000	0.7700	43.9837 (80)

Solar gains	107.4463	210.0804	346.2105	506.0686	621.7137	637.2173	606.3275	519.7308	402.9604	249.2952	133.9414	88.3855 (83)
Total gains	759.3906	856.8439	967.3738	1087.5437	1162.3265	1141.5585	1089.7408	1012.5400	918.8654	805.1183	734.0349	722.1877 (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	30.6856	30.7518	30.8170	31.1269	31.1856	31.4617	31.4617	Aug	Sep	Oct	Nov	Dec	
alpha	3.0457	3.0501	3.0545	3.0751	3.0790	3.0974	3.0974	3.1009	3.0903	3.0790	3.0711	3.0629	
util living area	0.9809	0.9713	0.9496	0.9000	0.8100	0.6721	0.5326	0.5820	0.7872	0.9280	0.9717	0.9836	(86)
MIT	18.9360	19.1508	19.5405	20.0532	20.5015	20.8091	20.9323	20.9095	20.6657	20.0764	19.4167	18.8959	(87)
Th 2	19.7701	19.7724	19.7747	19.7853	19.7873	19.7966	19.7966	19.7983	19.7930	19.7873	19.7833	19.7791	(88)
util rest of house	0.9767	0.9649	0.9380	0.8755	0.7607	0.5835	0.4068	0.4570	0.7142	0.9051	0.9643	0.9799	(89)
MIT 2	17.0599	17.3718	17.9336	18.6634	19.2672	19.6453	19.7626	19.7486	19.4936	18.7128	17.7671	17.0070	(90)
Living area fraction									fLA = Living area / (4) =			0.1160	(91)
MIT	17.2775	17.5781	18.1200	18.8245	19.4104	19.7803	19.8983	19.8832	19.6295	18.8710	17.9584	17.2261	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.1275	17.4281	17.9700	18.6745	19.2604	19.6303	19.7483	19.7332	19.4795	18.7210	17.8084	17.0761	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9466	0.9137	0.8464	0.7350	0.5696	0.4013	0.4495	0.6912	0.8772	0.9460	0.9671	(94)
Useful gains	730.9026	811.1218	883.8695	920.5479	854.3241	650.1991	437.3004	455.1204	635.0949	706.2597	694.3618	698.4203	(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	1903.3132	1854.8939	1694.6313	1429.7629	1103.8077	727.9713	455.6118	481.5849	781.1668	1185.6525	1569.3778	1894.5610	(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	872.2735	701.4148	603.2068	366.6348	185.6158	0.0000	0.0000	0.0000	0.0000	356.6682	630.0115	889.9287	(98)
Space heating													
Space heating per m2													(98) / (4) = 43.1816 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5089.2311 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	872.2735	701.4148	603.2068	366.6348	185.6158	0.0000	0.0000	0.0000	0.0000	356.6682	630.0115	889.9287	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	963.8381	775.0440	666.5268	405.1214	205.1003	0.0000	0.0000	0.0000	0.0000	394.1085	696.1453	983.3466	(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	152.8212	113.9335	90.1275	46.1664	18.6456	3.1876	0.0000	26.5809	49.4160	94.0242	129.8749	151.7678	(64)
Efficiency of water heater (217)m	90.0081	90.0388	90.0708	90.1305	90.1982	87.3000	87.3000	87.3000	87.3000	89.8132	89.9366	90.0193	(216)
Fuel for water heating, kWh/month	169.7860	126.5382	100.0630	51.2217	20.6719	3.6514	0.0000	30.4478	56.6048	104.6886	144.4073	168.5948	(219)
Water heating fuel used													976.6753 (219)
Annual totals kWh/year													
Space heating fuel - main system													5089.2311 (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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													441.2701 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses													4904.9371 (238)

10a. Fuel costs - using Table 12 prices

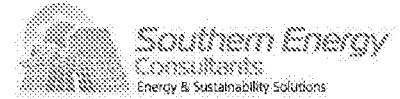
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5089.2311	3.4800	177.1052	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	976.6753	3.4800	33.9883	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	441.2701	13.1900	58.2035	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			177.9617	(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] =	0.4928	(257)
SAP value		93.1249	
SAP rating (Section 12)		93	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5089.2311	0.2160	1099.2739 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	976.6753	0.2160	210.9619 (264)
Space and water heating			1310.2358 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			707.6927 (272)
CO2 emissions per m2			6.6400 (273)
EI value			93.7471
EI rating			94 (274)
EI band			A

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (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) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3597	0.3425	0.3425	0.3169	0.3169	0.2826	0.2912	0.2740	0.2826	0.2997	0.2997	0.3254 (22b)
Effective ac	0.5647	0.5587	0.5587	0.5502	0.5502	0.5399	0.5424	0.5375	0.5399	0.5449	0.5449	0.5529 (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
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7209	48.2021	48.2021	47.4713	47.4713	46.5854	46.7974	46.3798	46.5854	47.0157	47.0157	47.7085 (38)
Heat transfer coeff	145.7299	145.2111	145.2111	144.4803	144.4803	143.5945	143.8064	143.3888	143.5945	144.0247	144.0247	144.7176 (39)
Average = Sum(39)m / 12 =												144.3553 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3663	1.3614	1.3614	1.3546	1.3546	1.3463	1.3483	1.3444	1.3463	1.3503	1.3503	1.3568 (40)
HLP (average)												1.3534 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

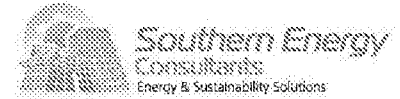
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7932 (42)
 Average daily hot water use (litres/day) 100.5390 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
Distribution loss	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2108 (H8)
Utilisation factor												0.5622 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5390 (H14)
Volume ratio Veff/V												0.7460 (H15)
Solar storage volume factor												0.9414 (H16)
Solar input												-891.2684 (H17)
Solar input	-27.4328	-41.2314	-69.4390	-95.9859	-115.5993	-121.6632	-118.7419	-106.0372	-82.7624	-56.3017	-33.3453	-22.7282 (63)
								Solar input (sum of months) = Sum(63)m =				-891.2684 (63)
Output from w/h	150.7234	114.9788	92.6908	46.6777	22.2605	0.0000	0.0000	21.5943	45.7965	91.7678	126.5806	150.2406 (64)
								Total per year (kWh/year) = Sum(64)m =				863.3110 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (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	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	(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)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336	(72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF	Access factor Table 6d	Gains W
North	0.6600	11.9814	0.4400		0.0000	0.7700	2.6791 (74)
East	9.1800	22.3313	0.4400		0.0000	0.7700	69.4545 (76)
West	6.6100	22.3313	0.4400		0.0000	0.7700	50.0103 (80)

Solar gains	122.1439	214.8637	349.2353	524.6946	626.7549	686.9382	646.7756	567.7986	440.1563	272.1220	155.9962	99.4952 (83)
Total gains	774.0882	861.6272	970.3986	1106.1696	1167.3677	1191.2794	1130.1889	1060.6078	956.0613	827.9451	756.0898	733.2975 (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	31.2431	31.3548	31.3548	31.5134	31.5134	31.7078	31.6610	31.7532	31.7078	31.6130	31.6130	31.4617
alpha	3.0829	3.0903	3.0903	3.1009	3.1009	3.1139	3.1107	3.1169	3.1139	3.1075	3.1075	3.0974
util living area												
	0.9771	0.9671	0.9401	0.8746	0.7524	0.5462	0.3809	0.4140	0.7024	0.9028	0.9635	0.9801 (86)
MIT	19.1297	19.3168	19.7252	20.2353	20.6665	20.9189	20.9816	20.9762	20.8058	20.2705	19.6239	19.0994 (87)
Th 2	19.7893	19.7930	19.7930	19.7983	19.7983	19.8048	19.8032	19.8063	19.8048	19.8016	19.8016	19.7966 (88)
util rest of house												
	0.9718	0.9596	0.9257	0.8432	0.6875	0.4358	0.2399	0.2678	0.6049	0.8709	0.9535	0.9755 (89)
MIT 2	17.3525	17.6243	18.2093	18.9227	19.4820	19.7568	19.7988	19.7999	19.6586	18.9907	18.0770	17.3134 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	17.5586	17.8206	18.3851	19.0750	19.6194	19.8915	19.9359	19.9363	19.7916	19.1392	18.2564	17.5205 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4086	17.6706	18.2351	18.9250	19.4694	19.7415	19.7859	19.7863	19.6416	18.9892	18.1064	17.3705 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9560	0.9401	0.9001	0.8144	0.6668	0.4294	0.2378	0.2653	0.5895	0.8418	0.9327	0.9610	(94)
Useful gains	739.9992	809.9942	873.4437	900.8266	778.3545	511.5822	268.7723	281.3397	563.5609	697.0035	705.1727	704.7243	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1793.7335	1752.7786	1573.3777	1303.9283	934.6974	537.2651	271.2112	284.8149	637.7960	1064.2207	1455.5693	1775.7597	(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	783.9783	633.5511	520.7509	290.2332	116.3191	0.0000	0.0000	0.0000	0.0000	273.2096	540.2855	796.8503	(98)
Space heating												3955.1782	(98)
Space heating per m2											(98) / (4) =	37.0821	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4370.3626 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	783.9783	633.5511	520.7509	290.2332	116.3191	0.0000	0.0000	0.0000	0.0000	273.2096	540.2855	796.8503	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	866.2744	700.0565	575.4154	320.6996	128.5294	0.0000	0.0000	0.0000	0.0000	301.8891	597.0006	880.4976	(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	150.7234	114.9788	92.6908	46.6777	22.2605	0.0000	0.0000	21.5943	45.7965	91.7678	126.5806	150.2406	(64)
Efficiency of water heater	89.9682	89.9933	90.0015	90.0427	89.9703	87.3000	87.3000	87.3000	87.3000	89.6735	89.6747	89.9768	(216)
(217)m	89.9682	89.9933	90.0015	90.0427	89.9703	87.3000	87.3000	87.3000	87.3000	89.6735	89.6747	89.9768	(217)
Fuel for water heating, kWh/month	167.5296	127.7638	102.9881	51.8395	24.7421	0.0000	0.0000	24.7357	52.4587	102.3354	140.8412	166.9770	(219)
Water heating fuel used												962.2111	(219)
Annual totals kWh/year													
Space heating fuel - main system												4370.3626	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												441.2701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses												4074.6842	(238)

10a. Fuel costs - using BEDF prices (470)

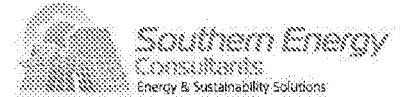
	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	4370.3626	3.8700	169.1330	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	962.2111	3.8700	37.2376	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	441.2701	18.9000	83.4000	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			61.6295	(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	4370.3626	0.2160	943.9983	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	962.2111	0.2160	207.8376	(264)
Space and water heating			1151.8359	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	441.2701	0.5190	229.0192	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			498.9912 (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	4370.3626	1.2200	5331.8424 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.2111	1.2200	1173.8976 (264)
Space and water heating			6505.7400 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	441.2701	3.0700	1354.6992 (268)

Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2644.0190 (272)
Primary energy kWh/m2/year			24.7892 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	153.7 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	345.12 (P1)
Transmission heat loss coefficient	97.01 (37)
Summer heat loss coefficient	442.13 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.6600	81.1852	0.4400	0.0000	0.9000	21.2186
East	9.1800	117.5071	0.4400	0.0000	0.9000	427.1711
West	6.6100	117.5071	0.4400	0.0000	0.9000	307.5818

total: 755.9715

	Jun	Jul	Aug	
Solar gains	803	756	664	(P4)
Internal gains	501	480	490	
Total summer gains	1304	1236	1153	(P5)

Summer gain/loss ratio	2.95	2.80	2.61	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 153.7)	0.92	0.92	0.92	
Threshold temperature	19.87	21.62	21.33	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight