

FULL SAP CALCULATION PRINTOUT

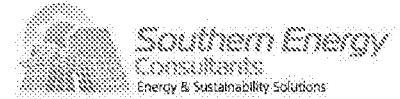
Calculation Type: New Build (As Designed)



Property Reference	SECANG011			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Longthopre, Plot 71,72				
SAP Rating	83 B	DER	18.26	TER	18.85
Environmental	84 B	% DER<TER	3.15		
CO ₂ Emissions (t/year)	1.63	DFEE	57.28	TFEE	62.01
General Requirements Compliance	Pass	% DFEE<TFEE	7.62		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey stuart@southernenergyconsultants.co.uk			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) 18.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.26 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 57.3 kWh/m²/yrOK

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:

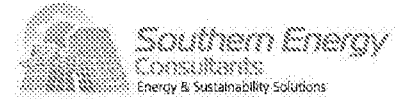
Overshading:
Average
Windows facing North East: 9.18 m², No overhang
Windows facing South East: 0.66 m², No overhang
Windows facing South West: 6.62 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 2 (Uw = 1.30)			16.4600	1.2357	20.3403			(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000	(29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500	(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, m2)			288.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	81.6576				(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) =	16390.4100			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					153.6697			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)					15.4607			(36)
Total fabric heat loss				(33) + (36) =	97.1183			(37)

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

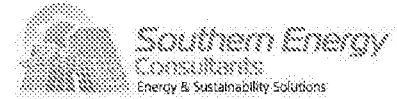
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.4872	148.1676	147.8544	146.3833	146.1081	144.8268	144.8268	144.5895	145.3203	146.1081	146.6649	147.2470 (39)
Average = Sum(39)m / 12 =												146.3820 (39)
HLP	1.3922	1.3892	1.3862	1.3724	1.3698	1.3578	1.3578	1.3556	1.3625	1.3698	1.3751	1.3805 (40)
HLP (average)												1.3724 (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	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)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	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)
Energy content (annual)										Total = Sum(45)m =		1581.8696 (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)
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)
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)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
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	24.9834	22.1901	18.0462	13.6621	10.2126	8.6219	9.3163	12.1096	16.2535	20.6376	24.0871	25.6778 (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	437.5993	435.2465	419.2979	393.4989	367.0418	341.8314	325.6569	332.2248	345.6689	371.6979	401.5632	424.2107 (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				
Northeast				9.1800	11.2829	0.4400	0.0000			0.7700	35.0920 (75)				
Southeast				0.6600	36.7938	0.4400	0.0000			0.7700	8.2274 (77)				
Southwest				6.6200	36.7938	0.4400	0.0000			0.7700	82.5233 (79)				
Solar gains				125.8427	226.0128	340.2014	473.4211	577.6385	594.2967	564.2947	483.3585	385.8337	258.1401	152.8532	106.3216 (83)
Total gains				563.4420	661.2592	759.4993	866.9200	944.6803	936.1281	889.9516	815.5833	731.5026	629.8380	554.4164	530.5323 (84)

7. Mean internal temperature (heating season)

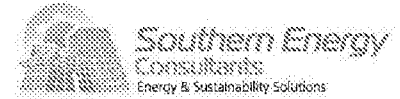
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6619	30.7280	30.7931	31.1025	31.1611	31.4368	31.4368	31.4884	31.3300	31.1611	31.0428	30.9201
alpha	3.0441	3.0485	3.0529	3.0735	3.0774	3.0958	3.0958	3.0992	3.0887	3.0774	3.0695	3.0613
util living area	0.9915	0.9855	0.9724	0.9399	0.8712	0.7521	0.6190	0.6744	0.8591	0.9599	0.9866	0.9929 (86)
MIT	18.7126	18.9340	19.3242	19.8557	20.3585	20.7324	20.8963	20.8617	20.5510	19.9046	19.2163	18.6751 (87)
Th 2	19.7694	19.7717	19.7739	19.7845	19.7865	19.7958	19.7958	19.7975	19.7922	19.7865	19.7825	19.7783 (88)
util rest of house	0.9895	0.9820	0.9655	0.9234	0.8317	0.6682	0.4847	0.5454	0.7997	0.9458	0.9828	0.9913 (89)
MIT 2	16.7358	17.0593	17.6269	18.3951	19.0924	19.5724	19.7404	19.7159	19.3667	18.4774	17.4791	16.6862 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	16.9650	17.2767	17.8237	18.5645	19.2393	19.7069	19.8744	19.8488	19.5041	18.6429	17.6806	16.9169 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8150	17.1267	17.6737	18.4145	19.0893	19.5569	19.7244	19.6988	19.3541	18.4929	17.5306	16.7669 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9814	0.9701	0.9474	0.8972	0.8026	0.6483	0.4756	0.5330	0.7714	0.9229	0.9713	0.9843 (94)
Useful gains	552.9762	641.4794	719.5220	777.7647	758.1957	606.8806	423.2679	434.7261	564.2479	581.2775	538.4807	522.2196 (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	1858.3224	1811.6063	1652.0852	1392.7633	1079.6301	717.8979	452.5031	476.9657	763.5224	1153.2229	1529.8059	1850.4344 (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	971.1775	786.3253	693.8270	442.7990	239.1472	0.0000	0.0000	0.0000	0.0000	425.5274	713.7541	988.1918 (98)
Space heating												5260.7493 (98)
Space heating per m2										(98) / (4) =		49.3226 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5812.9826 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	971.1775	786.3253	693.8270	442.7990	239.1472	0.0000	0.0000	0.0000	0.0000	425.5274	713.7541	988.1918	(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)	1073.1243	868.8677	766.6597	489.2806	264.2510	0.0000	0.0000	0.0000	0.0000	470.1960	788.6786	1091.9247	(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	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	89.9887	89.9535	89.8760	89.6988	89.3030	87.3000	87.3000	87.3000	87.3000	89.6517	89.8968	87.3000	(216)
Fuel for water heating, kWh/month	197.9762	173.6566	180.3928	159.0474	154.3731	137.9085	129.4194	146.1988	147.2610	165.1608	177.8993	192.1694	(219)
Water heating fuel used												1961.4634	(219)
Annual totals kWh/year													
Space heating fuel - main system												5812.9826	(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)												441.2152	(232)
Total delivered energy for all uses												8290.6612	(238)

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

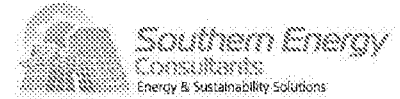
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5812.9826	0.2160	1255.6043	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.4634	0.2160	423.6761	(264)
Space and water heating			1679.2803	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	441.2152	0.5190	228.9907	(268)
Total CO2, kg/year			1947.1960	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2600	(273)

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

DER		18.2600	ZC1
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	ZC2
CO2 emissions from cooking, equation (L16)		1.7442	ZC3
Total CO2 emissions		34.8196	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.8196	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)
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)			16.4600	1.3258	21.8220		(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	139.3100	18.6100	120.7000	0.1800	21.7260		(29a)
Solid Garage Wall	19.5500		19.5500	0.1800	3.5190		(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) =	66.5366		(32)
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) =	84.4520 (37)

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

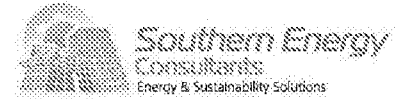
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	135.8208	135.5013	135.1881	133.7170	133.4418	132.1605	132.1605	131.9232	132.6540	133.4418	133.9986	134.5807 (39)
Average = Sum(39)m / 12 =												133.7157 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2734	1.2704	1.2675	1.2537	1.2511	1.2391	1.2391	1.2369	1.2437	1.2511	1.2563	1.2618 (40)
HLP (average)												1.2537 (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	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 conte	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)
Energy content (annual)										Total = Sum(45)m =		1581.8696 (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)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	50.9589	46.0274	50.9589	48.5892	48.1595	44.6228	46.1102	48.1595	48.5892	50.9589	49.3151	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 (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	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)
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)

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	24.9834	22.1901	18.0462	13.6621	10.2126	8.6219	9.3163	12.1096	16.2535	20.6376	24.0871	25.6778 (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	449.9678	447.6192	431.6793	405.6417	378.5076	352.6223	336.4562	343.6984	357.8233	384.0906	413.9421	436.5834 (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	
Northeast			9.1800	11.2829		0.6300		0.7000		0.7700	31.6546 (75)	
Southeast			0.6600	36.7938		0.6300		0.7000		0.7700	7.4215 (77)	
Southwest			6.6200	36.7938		0.6300		0.7000		0.7700	74.4397 (79)	
Solar gains	113.5158	203.8738	306.8771	427.0474	521.0562	536.0826	509.0195	436.0113	348.0395	232.8541	137.8806	95.9069 (83)
Total gains	563.4836	651.4930	738.5565	832.6890	899.5638	888.7050	845.4756	779.7097	705.8628	616.9447	551.8226	532.4903 (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	54.5347	54.6633	54.7899	55.3927	55.5069	56.0451	56.0451	56.1459	55.8366	55.5069	55.2763	55.0372
alpha	4.6356	4.6442	4.6527	4.6928	4.7005	4.7363	4.7363	4.7431	4.7224	4.7005	4.6851	4.6691
util living area	0.9988	0.9974	0.9933	0.9780	0.9278	0.8047	0.6465	0.7094	0.9133	0.9876	0.9976	0.9991 (86)
MIT	19.5314	19.6802	19.9426	20.3055	20.6487	20.8867	20.9697	20.9534	20.7657	20.3269	19.8667	19.5080 (87)
Th 2	19.8617	19.8641	19.8664	19.8773	19.8793	19.8889	19.8889	19.8906	19.8852	19.8793	19.8752	19.8709 (88)
util rest of house	0.9984	0.9965	0.9907	0.9685	0.8939	0.7145	0.5032	0.5697	0.8579	0.9807	0.9966	0.9988 (89)
MIT 2	17.9054	18.1245	18.5087	19.0401	19.5155	19.8077	19.8771	19.8699	19.6799	19.0774	18.4052	17.8775 (90)
Living area fraction	18.0940	18.3050	18.6750	19.1869	19.6469	19.9328	20.0038	19.9956	19.8058	19.2224	18.5747	18.0666 (92)
Temperature adjustment	18.0940	18.3050	18.6750	19.1869	19.6469	19.9328	20.0038	19.9956	19.8058	19.2224	18.5747	18.0666 (93)
adjusted MIT	18.0940	18.3050	18.6750	19.1869	19.6469	19.9328	20.0038	19.9956	19.8058	19.2224	18.5747	18.0666 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9973	0.9945	0.9866	0.9603	0.8850	0.7186	0.5192	0.5844	0.8528	0.9745	0.9947	0.9980 (94)
Ext temp.	561.9797	647.9099	728.6659	799.6230	796.0820	638.6614	438.9613	455.6785	601.9306	601.2079	548.9055	531.3994 (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	1873.5121	1816.3906	1645.9199	1375.5326	1060.4501	704.7865	449.8544	474.3422	756.9037	1150.5823	1537.5969	1866.1776 (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	975.7801	785.2190	682.4370	414.6549	196.6898	0.0000	0.0000	0.0000	0.0000	408.7346	711.8578	993.0750 (98)
Space heating per m2												5168.4482 (98)
												48.4572 (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

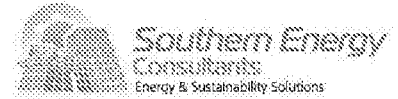
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5533.6705 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	975.7801	785.2190	682.4370	414.6549	196.6898	0.0000	0.0000	0.0000	0.0000	408.7346	711.8578	993.0750	(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)	1044.7325	840.7056	730.6606	443.9560	210.5887	0.0000	0.0000	0.0000	0.0000	437.6173	762.1604	1063.2494	(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	88.3929	88.2425	87.9040	87.1139	85.3898	80.3000	80.3000	80.3000	80.3000	86.9914	88.0141	88.4595	(216)
Fuel for water heating, kWh/month	243.1926	214.7131	226.3569	203.9112	201.4081	188.6327	180.7245	201.4655	203.6905	212.6076	222.2112	237.1594	(219)
Water heating fuel used												2536.0733	(219)
Annual totals kWh/year													
Space heating fuel - main system												5533.6705	(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)												441.2152	(232)
Total delivered energy for all uses												8585.9589	(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	5533.6705	0.2160	1195.2728 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2536.0733	0.2160	547.7918 (264)
Space and water heating			1743.0647 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2152	0.5190	228.9907 (268)
Total CO2, kg/m2/year			2010.9803 (272)
Emissions per m2 for space and water heating			16.3423 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1469 (272b)
Emissions per m2 for pumps and fans			0.3649 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3423 * 1.00) + 2.1469 + 0.3649, rounded to 2 d.p.			18.8500 (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)			16.4600	1.2357	20.3403		(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (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) =		81.6576		(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) =	16020.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.1991 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.1183 (37)

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

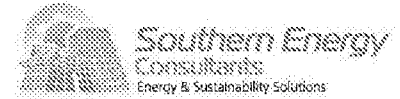
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.4872	148.1676	147.8544	146.3833	146.1081	144.8268	144.8268	144.5895	145.3203	146.1081	146.6649	147.2470 (39)
Average = Sum(39)m / 12 =												146.3820 (39)
HLP	1.3922	1.3892	1.3862	1.3724	1.3698	1.3578	1.3578	1.3556	1.3625	1.3698	1.3751	1.3805 (40)
HLP (average)												1.3724 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	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)
Energy content (annual)										Total =	Sum(45)m =	1581.8696 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	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	24.9834	22.1901	18.0462	13.6621	10.2126	8.6219	9.3163	12.1096	16.2535	20.6376	24.0871	25.6778 (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	403.3919	401.8815	387.6822	364.2628	339.3536	316.3201	301.9925	306.1904	318.7896	342.3558	369.4418	390.8422 (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
Northeast	9.1800	11.2829	0.4400	0.0000	0.7700	35.0920 (75)
Southeast	0.6600	36.7938	0.4400	0.0000	0.7700	8.2274 (77)
Southwest	6.6200	36.7938	0.4400	0.0000	0.7700	82.5233 (79)

Solar gains	125.8427	226.0128	340.2014	473.4211	577.6385	594.2967	564.2947	483.3585	385.8337	258.1401	152.8532	106.3216 (83)
Total gains	529.2346	627.8943	727.8836	837.6839	916.9921	910.6168	866.2872	789.5489	704.6233	600.4959	522.2950	497.1637 (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	29.9694	30.0340	30.0976	30.4001	30.4574	30.7268	30.7268	30.7772	30.6225	30.4574	30.3417	30.2218
alpha	2.9980	3.0023	3.0065	3.0267	3.0305	3.0485	3.0485	3.0518	3.0415	3.0305	3.0228	3.0148
util living area	0.9923	0.9865	0.9740	0.9425	0.8758	0.7596	0.6284	0.6853	0.8662	0.9628	0.9878	0.9937 (86)
MIT	18.6376	18.8639	19.2631	19.8076	20.3246	20.7133	20.8868	20.8487	20.5222	19.8559	19.1517	18.6002 (87)
Th 2	19.7694	19.7717	19.7739	19.7845	19.7865	19.7958	19.7958	19.7975	19.7922	19.7865	19.7825	19.7783 (88)
util rest of house	0.9905	0.9834	0.9675	0.9268	0.8377	0.6772	0.4943	0.5575	0.8093	0.9497	0.9844	0.9922 (89)
MIT 2	17.6267	17.8533	18.2507	18.7922	19.2841	19.6303	19.7536	19.7352	19.4793	18.8483	18.1488	17.5957 (90)
Living area fraction	17.7440	17.9705	18.3681	18.9100	19.4048	19.7559	19.8850	19.8644	19.6003	18.9652	18.2651	17.7122 (92)
Temperature adjustment	17.7440	17.9705	18.3681	18.9100	19.4048	19.7559	19.8850	19.8644	19.6003	18.9652	18.2651	17.7122 (93)
adjusted MIT	17.7440	17.9705	18.3681	18.9100	19.4048	19.7559	19.8850	19.8644	19.6003	18.9652	18.2651	17.7122 (93)

8. Space heating requirement

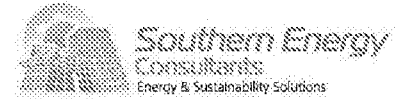
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	521.9316	613.3088	696.7388	763.8722	754.6209	613.7879	437.9037	446.6544	562.1454	562.9013	510.9353	491.4415 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1996.2539	1936.6227	1754.7570	1465.2909	1125.7361	746.7081	475.7584	500.9097	799.3018	1222.2217	1637.5302	1989.6314 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1096.8958	889.2670	787.1656	505.0215	276.1096	0.0000	0.0000	0.0000	0.0000	490.5344	811.1483	1114.6533 (98)
Space heating												5970.7955 (98)
Space heating per m2										(98) / (4) =		55.9797 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

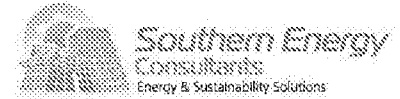


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1361.3721	1071.7184	1098.8805	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6946	0.7691	0.7290	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	945.5682	824.2593	801.0460	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1173.4597	1119.3112	1031.7354	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	164.0819	219.5186	171.6329	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			555.2335 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	41.0205	54.8797	42.9082	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												138.8084 (107)
Energy for space heating												1.3014 (108)
Energy for space cooling												55.9797 (99)
Total												1.3014 (108)
Dwelling Fabric Energy Efficiency (DFEE)												57.2811 (109)
												57.3 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1530 (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)			16.4600	1.3258	21.8220		(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	139.3100	18.6100	120.7000	0.1800	21.7260		(29a)
Solid Garage Wall	19.5500		19.5500	0.1800	3.5190		(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) =		66.5366		(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) =	84.4520 (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	135.8208	135.5013	135.1881	133.7170	133.4418	132.1605	132.1605	131.9232	132.6540	133.4418	133.9986	134.5807 (39)
Average = Sum(39)m / 12 =												133.7157 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2734	1.2704	1.2675	1.2537	1.2511	1.2391	1.2391	1.2369	1.2437	1.2511	1.2563	1.2618 (40)
HLP (average)												1.2537 (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	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 conte	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)
Energy content (annual)										Total = Sum(45)m =		1581.8696 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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 TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	24.9834	22.1901	18.0462	13.6621	10.2126	8.6219	9.3163	12.1096	16.2535	20.6376	24.0871	25.6778	(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	403.3919	401.8815	387.6822	364.2628	339.3536	316.3201	301.9925	306.1904	318.7896	342.3558	369.4418	390.8422	(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
Northeast	9.1800	11.2829	0.6300	0.7000	0.7700	31.6546 (75)
Southeast	0.6600	36.7938	0.6300	0.7000	0.7700	7.4215 (77)
Southwest	6.6200	36.7938	0.6300	0.7000	0.7700	74.4397 (79)

Solar gains	113.5158	203.8738	306.8771	427.0474	521.0562	536.0826	509.0195	436.0113	348.0395	232.8541	137.8806	95.9069	(83)
Total gains	516.9077	605.7553	694.5593	791.3102	860.4098	852.4027	811.0120	742.2017	666.8292	575.2099	507.3224	486.7491	(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	54.5347	54.6633	54.7899	55.3927	55.5069	56.0451	56.0451	56.1459	55.8366	55.5069	55.2763	55.0372	
alpha	4.6356	4.6442	4.6527	4.6928	4.7005	4.7363	4.7363	4.7431	4.7224	4.7005	4.6851	4.6691	
util living area	0.9992	0.9981	0.9948	0.9819	0.9374	0.8225	0.6677	0.7339	0.9273	0.9906	0.9984	0.9994	(86)
MIT	19.4915	19.6413	19.9058	20.2732	20.6244	20.8746	20.9654	20.9461	20.7429	20.2928	19.8286	19.4687	(87)
Th 2	19.8617	19.8641	19.8664	19.8773	19.8793	19.8889	19.8889	19.8906	19.8852	19.8793	19.8752	19.8709	(88)
util rest of house	0.9989	0.9974	0.9928	0.9739	0.9068	0.7352	0.5226	0.5943	0.8778	0.9852	0.9976	0.9992	(89)
MIT 2	18.4862	18.6376	18.9031	19.2748	19.6102	19.8262	19.8795	19.8738	19.7276	19.2987	18.8337	18.4706	(90)
Living area fraction									fLA = Living area / (4) =			0.1160	(91)
MIT	18.6028	18.7540	19.0194	19.3905	19.7278	19.9478	20.0054	19.9982	19.8453	19.4140	18.9491	18.5864	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6028	18.7540	19.0194	19.3905	19.7278	19.9478	20.0054	19.9982	19.8453	19.4140	18.9491	18.5864	(93)

8. Space heating requirement

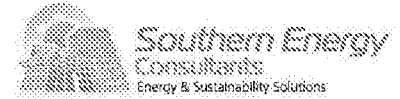
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	516.0875	603.6051	688.0218	766.8804	775.6734	631.2785	437.3152	452.4375	583.7992	564.8472	505.6731	486.1710	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1942.6192	1877.2364	1692.4709	1402.7648	1071.2487	706.7661	450.0628	474.6810	762.1388	1176.1586	1587.7617	1936.1297	(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	1061.3395	855.8803	747.3102	457.8368	219.9080	0.0000	0.0000	0.0000	0.0000	454.8157	779.1038	1078.7693	(98)
Space heating												5654.9635	(98)
Space heating per m2										(98) / (4) =		53.0186	(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	1242.3087	977.9877	1002.6165	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7743	0.8553	0.8148	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	961.8755	836.4923	816.8872	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1105.4173	1054.7038	976.3946	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

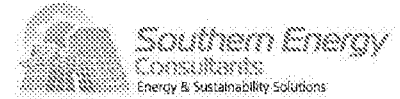


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	103.3501	162.3494	118.6735	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												384.3729 (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	25.8375	40.5873	29.6684	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												96.0932 (107)
Space cooling per m2												0.9009 (108)
Energy for space heating												53.0186 (99)
Energy for space cooling												0.9009 (108)
Total												53.9195 (109)
Target Fabric Energy Efficiency (TFEE)												62.0 (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	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				40.0000 / (5) =	0.1530 (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)			16.4600	1.2357	20.3403		(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (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) =	81.6576			(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) =	16390.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.1183 (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	145.8392	145.3203	145.3203	144.5895	144.5895	143.7037	143.9157	143.4981	143.7037	144.1340	144.1340	144.8268 (39)
Average = Sum(39)m / 12 =												144.4646 (39)
HLP	1.3673	1.3625	1.3625	1.3556	1.3556	1.3473	1.3493	1.3454	1.3473	1.3513	1.3513	1.3578 (40)
HLP (average)												1.3544 (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	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)

Regs Region: England

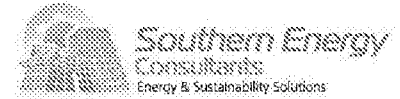
Elmhurst Energy Systems

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 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	1581.8696 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	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	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)
Heat gains from water heating, kWh/month												
Total per year (kWh/year) = Sum(64)m =												1748 (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	62.4586	55.4751	45.1154	34.1553	25.5315	21.5547	23.2907	30.2741	40.6338	51.5940	60.2178	64.1945 (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	651.9365	646.7566	621.1577	581.4708	540.6097	504.3385	483.4104	492.8054	515.8999	555.8167	600.0861	633.7943 (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	
Northeast				9.1800	12.9236		0.4400	0.0000	0.7700		40.1946 (75)	
Southeast				0.6600	40.4699		0.4400	0.0000	0.7700		9.0494 (77)	
Southwest				6.6200	40.4699		0.4400	0.0000	0.7700		90.7682 (79)	

Solar gains	140.0122	226.9651	339.2605	489.1468	583.0447	642.3847	603.2111	527.4426	418.0325	277.2991	174.3653	117.0673 (83)
Total gains	791.9488	873.7217	960.4182	1070.6176	1123.6544	1146.7232	1086.6215	1020.2480	933.9324	833.1158	774.4513	750.8615 (84)

7. Mean internal temperature (heating season)

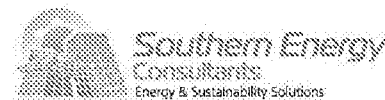
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.2186	31.3300	31.3300	31.4884	31.4884	31.6825	31.6358	31.7279	31.6825	31.5879	31.5879	31.4368
alpha	3.0812	3.0887	3.0887	3.0992	3.0992	3.1122	3.1091	3.1152	3.1122	3.1059	3.1059	3.0958
util living area	0.9757	0.9659	0.9416	0.8828	0.7669	0.5626	0.3950	0.4287	0.7122	0.9016	0.9612	0.9788 (86)
MIT	19.1476	19.3279	19.7141	20.2072	20.6456	20.9117	20.9796	20.9737	20.7973	20.2738	19.6417	19.1173 (87)
Th 2	19.7885	19.7922	19.7922	19.7975	19.7975	19.8040	19.8024	19.8055	19.8040	19.8008	19.8008	19.7958 (88)
util rest of house	0.9701	0.9581	0.9275	0.8527	0.7033	0.4506	0.2494	0.2781	0.6152	0.8693	0.9507	0.9739 (89)
MIT 2	17.3777	17.6397	18.1934	18.8857	19.4587	19.7512	19.7974	19.7983	19.6504	18.9944	18.1015	17.3386 (90)
Living area fraction	17.5830	17.8355	18.3698	19.0389	19.5963	19.8858	19.9345	19.9347	19.7834	19.1428	18.2802	17.5449 (92)
MIT	17.4330	17.6855	18.2198	18.8889	19.4463	19.7358	19.7845	19.7847	19.6334	18.9928	18.1302	17.3949 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	755.2616	819.8034	866.3425	881.9287	765.7281	508.6960	268.4856	280.9201	559.3974	700.0341	719.6503	719.9876 (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	1798.6364	1756.2642	1572.3378	1299.7047	932.0692	536.8422	271.2147	284.7954	637.0978	1065.5517	1460.1004	1780.6298 (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 (98a)
Space heating kWh	776.2708	629.3017	525.2605	300.7987	123.7578	0.0000	0.0000	0.0000	0.0000	271.9451	533.1240	789.1178 (98)
Space heating												3949.5765 (98)
RHI space heating demand												3950 (98)

FULL SAP CALCULATION PRINTOUT

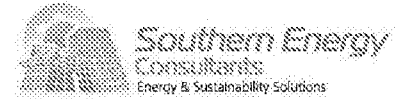
Calculation Type: New Build (As Designed)



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)			16.4600	1.2357	20.3403		(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (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) =		81.6576		(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) =	16390.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.1183 (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	148.4872	148.1676	147.8544	146.3833	146.1081	144.8268	144.8268	144.5895	145.3203	146.1081	146.6649	147.2470 (39)
Average = Sum(39)m / 12 =												146.3820 (39)
HLP	1.3922	1.3892	1.3862	1.3724	1.3698	1.3578	1.3578	1.3556	1.3625	1.3698	1.3751	1.3805 (40)
HLP (average)												1.3724 (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	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)

Regs Region: England

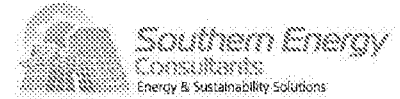
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	1581.8696 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	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)
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	62.4586	55.4751	45.1154	34.1553	25.5315	21.5547	23.2907	30.2741	40.6338	51.5940	60.2178	64.1945 (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	651.9365	646.7566	621.1577	581.4708	540.6097	504.3385	483.4104	492.8054	515.8999	555.8167	600.0861	633.7943 (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
Northeast				9.1800	11.2829		0.4400		0.0000		0.7700		35.0920 (75)
Southeast				0.6600	36.7938		0.4400		0.0000		0.7700		8.2274 (77)
Southwest				6.6200	36.7938		0.4400		0.0000		0.7700		82.5233 (79)
Solar gains	125.8427	226.0128	340.2014	473.4211	577.6385	594.2967	564.2947	483.3585	385.8337	258.1401	152.8532	106.3216	(83)
Total gains	777.7792	872.7694	961.3591	1054.8919	1118.2482	1098.6352	1047.7051	976.1639	901.7336	813.9568	752.9393	740.1158	(84)

7. Mean internal temperature (heating season)

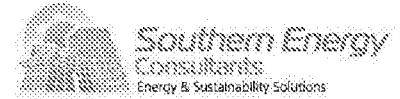
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6619	30.7280	30.7931	31.1025	31.1611	31.4368	31.4368	31.4884	31.3300	31.1611	31.0428	30.9201
alpha	3.0441	3.0485	3.0529	3.0735	3.0774	3.0958	3.0958	3.0992	3.0887	3.0774	3.0695	3.0613
util living area	0.9797	0.9699	0.9504	0.9064	0.8227	0.6883	0.5494	0.5979	0.7939	0.9262	0.9698	0.9824 (86)
MIT	18.9547	19.1662	19.5330	20.0248	20.4746	20.7950	20.9260	20.9022	20.6560	20.0833	19.4355	18.9143 (87)
Th 2	19.7694	19.7717	19.7739	19.7845	19.7865	19.7958	19.7958	19.7975	19.7922	19.7865	19.7825	19.7783 (88)
util rest of house	0.9752	0.9633	0.9389	0.8831	0.7751	0.6090	0.4214	0.4716	0.7219	0.9029	0.9620	0.9786 (89)
MIT 2	17.0863	17.3932	17.9226	18.6246	19.2346	19.6318	19.7583	19.7431	19.4827	18.7216	17.7934	17.0331 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	17.3030	17.5989	18.1094	18.7871	19.3784	19.7667	19.8937	19.8776	19.6187	18.8795	17.9838	17.2513 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1530	17.4489	17.9594	18.6371	19.2284	19.6167	19.7437	19.7276	19.4687	18.7295	17.8338	17.1013 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9604	0.9445	0.9147	0.8541	0.7485	0.5850	0.4153	0.4634	0.6983	0.8748	0.9429	0.9652 (94)
Useful gains	746.9842	824.3334	879.3858	901.0294	836.9953	642.7363	435.1211	452.3115	629.6761	712.0777	709.9745	714.3400 (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	1908.4996	1859.3347	1694.3174	1425.3554	1099.9588	726.5498	455.2905	481.1307	780.1856	1187.7908	1574.2762	1899.6737 (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	864.1675	695.5209	606.3091	377.5147	195.6449	0.0000	0.0000	0.0000	0.0000	353.9305	622.2972	881.8882 (98)
Space heating												4597.2730 (98)
Space heating per m2										(98) / (4) =		43.1021 (99)

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												5079.8597 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	864.1675	695.5209	606.3091	377.5147	195.6449	0.0000	0.0000	0.0000	0.0000	353.9305	622.2972	881.8882 (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)	954.8812	768.5314	669.9548	417.1433	216.1822	0.0000	0.0000	0.0000	0.0000	391.0835	687.6212	974.4621 (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	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	89.9365	89.8957	89.8055	89.5993	89.1492	87.3000	87.3000	87.3000	87.3000	89.5320	89.8268	87.3000 (216)
Fuel for water heating, kWh/month	198.0910	173.7684	180.5344	159.2241	154.6394	137.9085	129.4194	146.1988	147.2610	165.3816	178.0380	192.2746 (219)
Water heating fuel used												1962.7393 (219)
Annual totals kWh/year												
Space heating fuel - main system												5079.8597 (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)												441.2152 (232)
Total delivered energy for all uses												7558.8142 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5079.8597	3.4800	176.7791 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1962.7393	3.4800	68.3033 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	441.2152	13.1900	58.1963 (250)
Additional standing charges			120.0000 (251)
Total energy cost			433.1712 (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] =	1.1996 (257)
SAP value		83.2655
SAP rating (Section 12)		83 (258)
SAP band		B

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

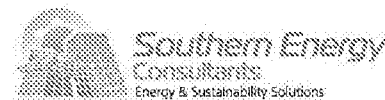
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5079.8597	0.2160	1097.2497 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1962.7393	0.2160	423.9517 (264)
Space and water heating			1521.2014 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2152	0.5190	228.9907 (268)
Total kg/year			1789.1170 (272)
CO2 emissions per m2			16.7700 (273)
EI value			84.1922
EI rating			84 (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	$0.216 / 0.8891 = 0.2429$, stars = 4

FULL SAP CALCULATION PRINTOUT

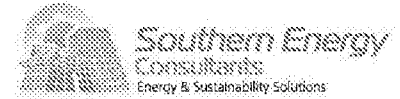
Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of EPC Costs, Emissions and Primary Energy 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
Calculation of EPC Costs, Emissions and Primary Energy 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)			16.4600	1.2357	20.3403		(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (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) =	81.6576		(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) =	16390.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.1183 (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	145.8392	145.3203	145.3203	144.5895	144.5895	143.7037	143.9157	143.4981	143.7037	144.1340	144.1340	144.8268 (39)
Average = Sum(39)m / 12 =												144.4646 (39)
HLP	1.3673	1.3625	1.3625	1.3556	1.3556	1.3473	1.3493	1.3454	1.3473	1.3513	1.3513	1.3578 (40)
HLP (average)												1.3544 (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	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)

Regs Region: England

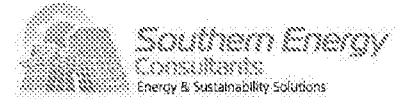
Elmhurst Energy Systems

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	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)
Energy content (annual)										Total =	Sum(45)m =	1581.8696 (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)
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)
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)

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	62.4586	55.4751	45.1154	34.1553	25.5315	21.5547	23.2907	30.2741	40.6338	51.5940	60.2178	64.1945	(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	651.9365	646.7566	621.1577	581.4708	540.6097	504.3385	483.4104	492.8054	515.8999	555.8167	600.0861	633.7943	(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
Northeast			9.1800		12.9236		0.4400		0.0000		0.7700		40.1946 (75)
Southeast			0.6600		40.4699		0.4400		0.0000		0.7700		9.0494 (77)
Southwest			6.6200		40.4699		0.4400		0.0000		0.7700		90.7682 (79)
Solar gains	140.0122	226.9651	339.2605	489.1468	583.0447	642.3847	603.2111	527.4426	418.0325	277.2991	174.3653	117.0673	(83)
Total gains	791.9488	873.7217	960.4182	1070.6176	1123.6544	1146.7232	1086.6215	1020.2480	933.9324	833.1158	774.4513	750.8615	(84)

7. Mean internal temperature (heating season)

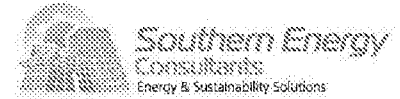
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.2186	31.3300	31.3300	31.4884	31.4884	31.6825	31.6358	31.7279	31.6825	31.5879	31.5879	31.4368	
alpha	3.0812	3.0887	3.0887	3.0992	3.0992	3.1122	3.1091	3.1152	3.1122	3.1059	3.1059	3.0958	
util living area	0.9757	0.9659	0.9416	0.8828	0.7669	0.5626	0.3950	0.4287	0.7122	0.9016	0.9612	0.9788	(86)
MIT	19.1476	19.3279	19.7141	20.2072	20.6456	20.9117	20.9796	20.9737	20.7973	20.2738	19.6417	19.1173	(87)
Th 2	19.7885	19.7922	19.7922	19.7975	19.7975	19.8040	19.8024	19.8055	19.8040	19.8008	19.8008	19.7958	(88)
util rest of house	0.9701	0.9581	0.9275	0.8527	0.7033	0.4506	0.2494	0.2781	0.6152	0.8693	0.9507	0.9739	(89)
MIT 2	17.3777	17.6397	18.1934	18.8857	19.4587	19.7512	19.7974	19.7983	19.6504	18.9944	18.1015	17.3386	(90)
Living area fraction									fLA = Living area / (4) =			0.1160	(91)
MIT	17.5830	17.8355	18.3698	19.0389	19.5963	19.8858	19.9345	19.9347	19.7834	19.1428	18.2802	17.5449	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4330	17.6855	18.2198	18.8889	19.4463	19.7358	19.7845	19.7847	19.6334	18.9928	18.1302	17.3949	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9537	0.9383	0.9020	0.8238	0.6815	0.4436	0.2471	0.2753	0.5990	0.8403	0.9292	0.9589	(94)
Useful gains	755.2616	819.8034	866.3425	881.9287	765.7281	508.6960	268.4856	280.9201	559.3974	700.0341	719.6503	719.9876	(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	1798.6364	1756.2642	1572.3378	1299.7047	932.0692	536.8422	271.2147	284.7954	637.0978	1065.5517	1460.1004	1780.6298	(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	776.2708	629.3017	525.2605	300.7987	123.7578	0.0000	0.0000	0.0000	0.0000	271.9451	533.1240	789.1178	(98)
Space heating												3949.5765	(98)
Space heating per m2										(98) / (4) =		37.0296	(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													4364.1729 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	776.2708	629.3017	525.2605	300.7987	123.7578	0.0000	0.0000	0.0000	0.0000	271.9451	533.1240	789.1178	(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)	857.7578	695.3610	580.3983	332.3743	136.7489	0.0000	0.0000	0.0000	0.0000	300.4918	589.0873	871.9534	(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	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	89.8850	89.8451	89.7243	89.4453	88.7851	87.3000	87.3000	87.3000	87.3000	89.3455	89.7409	87.3000	(216)
Fuel for water heating, kWh/month	198.2046	173.8662	180.6978	159.4983	155.2736	137.9085	129.4194	146.1988	147.2610	165.7269	178.2084	192.3853	(219)
Water heating fuel used												1964.6489	(219)
Annual totals kWh/year													
Space heating fuel - main system												4364.1729	(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)												441.2152	(232)
Total delivered energy for all uses												6845.0370	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4364.1729	3.8700	168.8935 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.6489	3.8700	76.0319 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	441.2152	18.9000	83.3897 (250)
Additional standing charges			93.0000 (251)
Total energy cost			435.4901 (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	4364.1729	0.2160	942.6614 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.6489	0.2160	424.3642 (264)
Space and water heating			1367.0255 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2152	0.5190	228.9907 (268)
Total kg/year			1634.9412 (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	4364.1729	1.2200	5324.2910 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.6489	1.2200	2396.8717 (264)
Space and water heating			7721.1627 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	441.2152	3.0700	1354.5305 (268)
Primary energy kWh/year			9305.9432 (272)
Primary energy kWh/m2/year			87.2487 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

(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 (11.7%)
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 B 86
Solar photovoltaic panels	£345	8.88 kg/m²	A 93 A 94
Total Savings	£374	10.66 kg/m²	

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

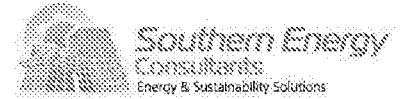
Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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)			16.4600	1.2357	20.3403		(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (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) =	81.6576		(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) =	16390.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.1183 (37)

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

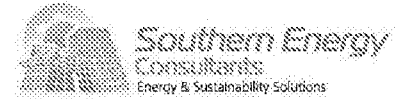
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.4872	148.1676	147.8544	146.3833	146.1081	144.8268	144.8268	144.5895	145.3203	146.1081	146.6649	147.2470 (39)
Average = Sum(39)m / 12 =												146.3820 (39)
HLP	1.3922	1.3892	1.3862	1.3724	1.3698	1.3578	1.3578	1.3556	1.3625	1.3698	1.3751	1.3805 (40)
HLP (average)												1.3724 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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)
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	62.4586	55.4751	45.1154	34.1553	25.5315	21.5547	23.2907	30.2741	40.6338	51.5940	60.2178	64.1945	(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	651.9365	646.7566	621.1577	581.4708	540.6097	504.3385	483.4104	492.8054	515.8999	555.8167	600.0861	633.7943	(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
Northeast	9.1800	11.2829	0.4400	0.0000	0.7700	35.0920 (75)
Southeast	0.6600	36.7938	0.4400	0.0000	0.7700	8.2274 (77)
Southwest	6.6200	36.7938	0.4400	0.0000	0.7700	82.5233 (79)

Solar gains	125.8427	226.0128	340.2014	473.4211	577.6385	594.2967	564.2947	483.3585	385.8337	258.1401	152.8532	106.3216 (83)
Total gains	777.7792	872.7694	961.3591	1054.8919	1118.2482	1098.6352	1047.7051	976.1639	901.7336	813.9568	752.9393	740.1158 (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	30.6619	30.7280	30.7931	31.1025	31.1611	31.4368	31.4368	31.4884	31.3300	31.1611	31.0428	30.9201
alpha	3.0441	3.0485	3.0529	3.0735	3.0774	3.0958	3.0958	3.0992	3.0887	3.0774	3.0695	3.0613
util living area												
	0.9797	0.9699	0.9504	0.9064	0.8227	0.6883	0.5494	0.5979	0.7939	0.9262	0.9698	0.9824 (86)
MIT	18.9547	19.1662	19.5330	20.0248	20.4746	20.7950	20.9260	20.9022	20.6560	20.0833	19.4355	18.9143 (87)
Th 2	19.7694	19.7717	19.7739	19.7845	19.7865	19.7958	19.7958	19.7975	19.7922	19.7865	19.7825	19.7783 (88)
util rest of house												
	0.9752	0.9633	0.9389	0.8831	0.7751	0.6000	0.4214	0.4716	0.7219	0.9029	0.9620	0.9786 (89)
MIT 2	17.0863	17.3932	17.9226	18.6248	19.2346	19.6318	19.7583	19.7431	19.4827	18.7216	17.7934	17.0331 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	17.3030	17.5989	18.1094	18.7871	19.3784	19.7667	19.8937	19.8776	19.6187	18.8795	17.9838	17.2513 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1530	17.4489	17.9594	18.6371	19.2284	19.6167	19.7437	19.7276	19.4687	18.7295	17.8338	17.1013 (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	0.9604	0.9445	0.9147	0.8541	0.7485	0.5850	0.4153	0.4634	0.6983	0.8748	0.9429	0.9652	(94)
Useful gains	746.9842	824.3334	879.3858	901.0294	836.9953	642.7363	435.1211	452.3115	629.6761	712.0777	709.9745	714.3400	(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	1908.4996	1859.3347	1694.3174	1425.3554	1099.9588	726.5498	455.2905	481.1307	780.1856	1187.7908	1574.2762	1899.6737	(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	864.1675	695.5209	606.3091	377.5147	195.6449	0.0000	0.0000	0.0000	0.0000	353.9305	622.2972	881.8882	(98)
Space heating												4597.2730	(98)
Space heating per m2											(98) / (4) =	43.1021	(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													5079.8597	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	864.1675	695.5209	606.3091	377.5147	195.6449	0.0000	0.0000	0.0000	0.0000	353.9305	622.2972	881.8882	(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)	954.8812	768.5314	669.9548	417.1433	216.1822	0.0000	0.0000	0.0000	0.0000	391.0835	687.6212	974.4621	(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	90.0042	90.0355	90.0727	90.1400	90.2123	87.3000	87.3000	87.3000	87.3000	89.8090	89.9308	87.3000	(216)	
(217)m	169.7934	126.5429	100.0609	51.2164	20.6686	3.6514	0.0000	30.4478	56.6048	104.6935	144.4165	168.6018	(219)	
Fuel for water heating, kWh/month	169.7934	126.5429	100.0609	51.2164	20.6686	3.6514	0.0000	30.4478	56.6048	104.6935	144.4165	168.6018	(219)	
Water heating fuel used												976.6977	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5079.8597	(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)												441.2152	(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												4895.5332	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5079.8597	3.4800	176.7791	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	976.6977	3.4800	33.9891	(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	441.2152	13.1900	58.1963	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			177.6291	(255)

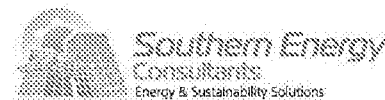
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.4919	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	93.1377	
SAP rating (Section 12)		93	(258)
SAP band		A	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

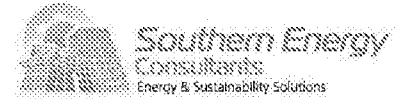


CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5079.8597	0.2160	1097.2497 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	976.6977	0.2160	210.9667 (264)
Space and water heating			1308.2164 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	441.2152	0.5190	228.9907 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			705.6448 (272)
CO2 emissions per m2			6.6200 (273)
EI value			93.7652
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	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)			16.4600	1.2357	20.3403		(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	139.3100	18.6100	120.7000	0.2500	30.1750	60.0000	7242.0000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (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) =		81.6576		(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) =	16390.4100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.1183 (37)

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

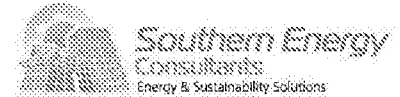
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7209	48.2021	48.2021	47.4713	47.4713	46.5854	46.7974	46.3798	46.5854	47.0157	47.0157	47.7085 (38)
Heat transfer coeff	145.8392	145.3203	145.3203	144.5895	144.5895	143.7037	143.9157	143.4981	143.7037	144.1340	144.1340	144.8268 (39)
Average = Sum(39)m / 12 =												144.4646 (39)
HLP	1.3673	1.3625	1.3625	1.3556	1.3556	1.3473	1.3493	1.3454	1.3473	1.3513	1.3513	1.3578 (40)
HLP (average)												1.3544 (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	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)

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 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:												
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi loss	14.1502	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												
(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	62.4586	55.4751	45.1154	34.1553	25.5315	21.5547	23.2907	30.2741	40.6338	51.5940	60.2178	64.1945 (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	651.9365	646.7566	621.1577	581.4708	540.6097	504.3385	483.4104	492.8054	515.8999	555.8167	600.0861	633.7943 (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			
Northeast				9.1800	12.9236	0.4400	0.0000	0.7700	40.1946 (75)			
Southeast				0.6600	40.4699	0.4400	0.0000	0.7700	9.0494 (77)			
Southwest				6.6200	40.4699	0.4400	0.0000	0.7700	90.7682 (79)			
Solar gains	140.0122	226.9651	339.2605	489.1468	583.0447	642.3847	603.2111	527.4426	418.0325	277.2991	174.3653	117.0673 (83)
Total gains	791.9488	873.7217	960.4182	1070.6176	1123.6544	1146.7232	1086.6215	1020.2480	933.9324	833.1158	774.4513	750.8615 (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	31.2186	31.3300	31.3300	31.4884	31.4884	31.6825	31.6358	31.7279	31.6825	31.5879	31.5879	31.4368
alpha	3.0812	3.0887	3.0887	3.0992	3.0992	3.1122	3.1091	3.1152	3.1122	3.1059	3.1059	3.0958
util living area	0.9757	0.9659	0.9416	0.8828	0.7669	0.5626	0.3950	0.4287	0.7122	0.9016	0.9612	0.9788 (86)
MIT	19.1476	19.3279	19.7141	20.2072	20.6456	20.9117	20.9796	20.9737	20.7973	20.2738	19.6417	19.1173 (87)
Th 2	19.7885	19.7922	19.7922	19.7975	19.7975	19.8040	19.8024	19.8055	19.8040	19.8008	19.8008	19.7958 (88)
util rest of house	0.9701	0.9581	0.9275	0.8527	0.7033	0.4506	0.2494	0.2781	0.6152	0.8693	0.9507	0.9739 (89)
MIT 2	17.3777	17.6397	18.1934	18.8857	19.4587	19.7512	19.7974	19.7983	19.6504	18.9944	18.1015	17.3386 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	17.5830	17.8355	18.3698	19.0389	19.5963	19.8858	19.9345	19.9347	19.7834	19.1428	18.2802	17.5449 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4330	17.6855	18.2198	18.8889	19.4463	19.7358	19.7845	19.7847	19.6334	18.9928	18.1302	17.3949 (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	0.9537	0.9383	0.9020	0.8238	0.6815	0.4436	0.2471	0.2753	0.5990	0.8403	0.9292	0.9589	(94)
Useful gains	755.2616	819.8034	866.3425	881.9287	765.7281	508.6960	268.4856	280.9201	559.3974	700.0341	719.6503	719.9876	(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	1798.6364	1756.2642	1572.3378	1299.7047	932.0692	536.8422	271.2147	284.7954	637.0978	1065.5517	1460.1004	1780.6298	(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	776.2708	629.3017	525.2605	300.7987	123.7578	0.0000	0.0000	0.0000	0.0000	271.9451	533.1240	789.1178	(98)
Space heating												3949.5765	(98)
Space heating per m2											(98) / (4) =	37.0296	(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													4364.1729 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	776.2708	629.3017	525.2605	300.7987	123.7578	0.0000	0.0000	0.0000	0.0000	271.9451	533.1240	789.1178	(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)	857.7578	695.3610	580.3983	332.3743	136.7489	0.0000	0.0000	0.0000	0.0000	300.4918	589.0873	871.9534	(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	89.9638	89.9904	90.0051	90.0566	89.9971	87.3000	87.3000	87.3000	87.3000	89.6707	89.8679	87.3000	(216)
(217)m	89.9638	89.9904	90.0051	90.0566	89.9971	87.3000	87.3000	87.3000	87.3000	89.6707	89.8679	89.9725	(217)
Fuel for water heating, kWh/month	167.5378	127.7679	102.9839	51.8316	24.7347	0.0000	0.0000	24.7357	52.4587	102.3386	140.8518	166.9850	(219)
Water heating fuel used												962.2257	(219)
Annual totals kWh/year													
Space heating fuel - main system												4364.1729	(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)												441.2152	(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												4068.4541	(238)

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

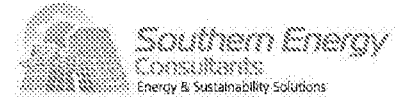
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4364.1729	3.8700	168.8935	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	962.2257	3.8700	37.2381	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	441.2152	18.9000	83.3897	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			61.3801	(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	4364.1729	0.2160	942.6614	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	962.2257	0.2160	207.8407	(264)
Space and water heating			1150.5021	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	441.2152	0.5190	228.9907	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			497.6289 (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	4364.1729	1.2200	5324.2910 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.2257	1.2200	1173.9153 (264)
Space and water heating			6498.2063 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	441.2152	3.0700	1354.5305 (268)

Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2636.3168 (272)
Primary energy kWh/m2/year			24.7170 (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	South 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	97.12 (37)
Summer heat loss coefficient	442.24 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	9.1800	98.8453	0.4400	0.0000	0.9000	359.3302
South East	0.6600	119.9223	0.4400	0.0000	0.9000	31.3429
South West	6.6200	119.9223	0.4400	0.0000	0.9000	314.3788

total: 705.0520

	Jun	Jul	Aug	
Solar gains	751	705	616	(P4)
Internal gains	501	480	490	
Total summer gains	1252	1185	1106	(P5)

	2.83	2.68	2.50	
Summer gain/loss ratio				(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	19.76	21.50	21.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight