

FULL SAP CALCULATION PRINTOUT

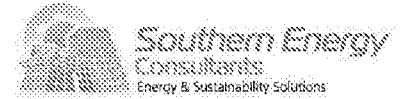
Calculation Type: New Build (As Designed)



Property Reference	SECANG011a			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br CI Ea Ga		
Property	Longthopre, Plot 43				
SAP Rating	83 B	DER	18.19	TET	18.79
Environmental	84 B	% DER<TER	3.18		
CO ₂ Emissions (t/year)	1.63	DPEE	57.14	TPEE	61.80
General Requirements Compliance	Pass	% DPEE<TPEE	7.55		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 107 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.19 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)57.1 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:

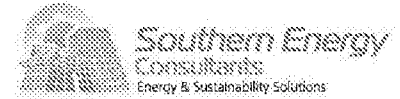
Overshading: Average
Windows facing East: 9.18 m², No overhang
Windows facing South: 0.66 m², No overhang
Windows facing West: 6.61 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
Average = Sum(39)m / 12 =												146.2728 (39)
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

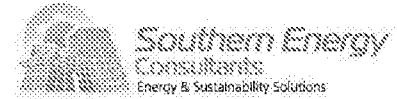
4. Water heating energy requirements (kWh/year)

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

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum(63)m =			0.0000 (63)
Output from w/h	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (65)
								Total per year (kWh/year) =	Sum(64)m =			1747.5516 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288 (71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336 (72)
Total internal gains	437.6024	435.2492	419.3002	393.5006	367.0431	341.8325	325.6581	332.2263	345.6709	371.7004	401.5662	424.2139 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East			9.1800	19.6403	0.4400	0.0000	0.7700	61.0848 (76)				
South			0.6600	46.7521	0.4400	0.0000	0.7700	10.4541 (78)				
West			6.6100	19.6403	0.4400	0.0000	0.7700	43.9837 (80)				
Solar gains	115.5227	222.6576	360.2986	518.3156	630.6927	644.0513	613.7816	529.9381	416.4594	262.3531	143.3999	95.4366 (83)
Total gains	553.1251	657.9068	779.5987	911.8162	997.7358	985.8838	939.4397	862.1644	762.1303	634.0535	544.9661	519.6505 (84)

7. Mean internal temperature (heating season)

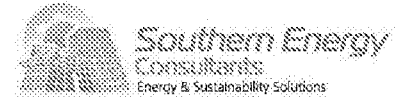
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6856	30.7518	30.8170	31.1269	31.1856	31.4617	31.4617	31.5134	31.3548	31.1856	31.0671	30.9442
alpha	3.0457	3.0501	3.0545	3.0751	3.0790	3.0974	3.0974	3.1009	3.0903	3.0790	3.0711	3.0629
util living area	0.9919	0.9857	0.9705	0.9324	0.8565	0.7318	0.5956	0.6507	0.8474	0.9593	0.9872	0.9933 (86)
MIT	18.7023	18.9318	19.3472	19.8993	20.3973	20.7542	20.9073	20.8755	20.5727	19.9100	19.2070	18.6641 (87)
Th 2	19.7701	19.7724	19.7747	19.7853	19.7873	19.7966	19.7966	19.7983	19.7930	19.7873	19.7833	19.7791 (88)
util rest of house	0.9900	0.9823	0.9631	0.9142	0.8143	0.6461	0.4630	0.5220	0.7853	0.9449	0.9836	0.9918 (89)
MIT 2	16.7213	17.0567	17.6602	18.4555	19.1413	19.5942	19.7479	19.7262	19.3921	18.4855	17.4661	16.6706 (90)
Living area fraction									fLA = Living area / (4) =			0.1160 (91)
MIT	16.9511	17.2741	17.8559	18.6229	19.2870	19.7287	19.8824	19.8595	19.5290	18.6507	17.6680	16.9018 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8011	17.1241	17.7059	18.4729	19.1370	19.5787	19.7324	19.7095	19.3790	18.5007	17.5180	16.7518 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9823	0.9704	0.9443	0.8871	0.7858	0.6279	0.4550	0.5110	0.7577	0.9219	0.9724	0.9851 (94)
Ext temp.	543.3121	638.4648	736.2139	808.8537	783.9949	618.9972	427.4536	440.5779	577.4733	584.5081	529.9296	511.9253 (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	1854.8812	1809.8842	1655.6141	1400.2696	1085.7915	720.5086	453.3066	478.1611	766.5688	1153.4924	1526.8179	1846.8486 (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	975.8075	787.1938	684.0338	425.8195	224.5367	0.0000	0.0000	0.0000	0.0000	423.3243	717.7596	993.1830 (98)
Space heating per m2										(98) / (4) =		49.0499 (99)

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Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5780.8377	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	975.8075	787.1938	684.0338	425.8195	224.5367	0.0000	0.0000	0.0000	0.0000	423.3243	717.7596	993.1830	(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)	1078.2403	869.8274	755.8384	470.5188	248.1068	0.0000	0.0000	0.0000	0.0000	467.7617	793.1045	1097.4398	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)	
Efficiency of water heater (217)m	89.9907	89.9540	89.8688	89.6751	89.2554	87.3000	87.3000	87.3000	87.3000	89.6485	89.8996	90.0106	(217)	
Fuel for water heating, kWh/month	197.9717	173.6557	180.4072	159.0895	154.4554	137.9085	129.4194	146.1988	147.2610	165.1668	177.8939	192.1649	(219)	
Water heating fuel used												1961.5928	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5780.8377	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													441.2701	(232)
Total delivered energy for all uses													8258.7006	(238)

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

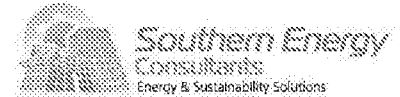
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5780.8377	0.2160	1248.6609 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1961.5928	0.2160	423.7040 (264)
Space and water heating			1672.3650 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total CO2, kg/year			1940.3092 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.1900 (273)

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

DER		18.1900	2C1
Total Floor Area	TFA	106.6600	
Assumed number of occupants	N	2.7932	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.8154	2C2
CO2 emissions from cooking, equation (L16)		1.7442	2C3
Total CO2 emissions		34.7496	2C4
Residual CO2 emissions offset from biofuel CHP		0.0000	2C5
Additional allowable electricity generation, kWh/m²/year		0.0000	2C6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	2C7
Net CO2 emissions		34.7496	2C8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			16.4500	1.3258	21.8087		(27)
Heat Loss Floor 1			45.7700	0.1300	5.9501		(28a)
Exposed Floor Over Garage			18.4800	0.1300	2.4024		(28b)
Brick Cavity	127.2500	16.4800	110.7700	0.1800	19.9386		(29a)
Solid Garage Wall	19.5500		19.5500	0.1800	3.5190		(29a)
Clad Cavity	12.0600	2.1200	9.9400	0.1800	1.7892		(29a)
Main Plane	60.8900		60.8900	0.1300	7.9157		(30)
Porch Roof	4.7800		4.7800	0.1300	0.6214		(30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5251		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.9154 (36)
Total fabric heat loss						(33) + (36) =	84.4405 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Average = Sum(39)m / 12 =	135.8094	135.4898	135.1766	133.7056	133.4303	132.1490	132.1490	131.9118	132.6426	133.4303	133.9871	134.5692 (39)
												133.7042 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2733	1.2703	1.2674	1.2536	1.2510	1.2390	1.2390	1.2368	1.2436	1.2510	1.2562	1.2617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7932 (42)
Average daily hot water use (litres/day)												100.5390 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
								Solar input (sum of months) = Sum(63)m = 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)
								Total per year (kWh/year) = Sum(64)m = 2165.2783 (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	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	90.4190	88.0966	83.2738	76.4653	71.5199	64.8376	59.7432	66.9592	69.9670	77.0052	84.6679	88.1063	(72)
Total internal gains	449.9709	447.6219	431.6816	405.6434	378.5089	352.6234	336.4573	343.6999	357.8253	384.0932	413.9451	436.5866	(73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					9.1800	19.6403	0.6300	0.7000	0.7700		55.1013 (76)	
South					0.6600	46.7521	0.6300	0.7000	0.7700		9.4301 (78)	
West					6.6100	19.6403	0.6300	0.7000	0.7700		39.6753 (80)	
Solar gains	104.2067	200.8473	325.0057	467.5443	568.9135	580.9636	553.6589	478.0282	375.6653	236.6544	129.3532	86.0882 (83)
Total gains	554.1776	648.4692	756.6873	873.1876	947.4224	933.5870	890.1162	821.7281	733.4906	620.7476	543.2983	522.6747 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5393	54.6679	54.7946	55.3974	55.5117	56.0499	56.0499	56.1507	55.8414	55.5117	55.2810	55.0419	
alpha	4.6360	4.6445	4.6530	4.6932	4.7008	4.7367	4.7367	4.7434	4.7228	4.7008	4.6854	4.6695	
util living area	0.9989	0.9975	0.9926	0.9737	0.9153	0.7826	0.6202	0.6829	0.9028	0.9873	0.9978	0.9992	(86)
MIT	19.5236	19.6778	19.9578	20.3366	20.6769	20.9002	20.9745	20.9604	20.7809	20.3301	19.8595	19.4997	(87)
Th 2	19.8618	19.8642	19.8665	19.8774	19.8794	19.8889	19.8889	19.8907	19.8853	19.8794	19.8753	19.8710	(88)
util rest of house	0.9985	0.9966	0.9898	0.9627	0.8774	0.6897	0.4798	0.5440	0.8434	0.9802	0.9968	0.9989	(89)
MIT 2	17.8940	18.1211	18.5308	19.0835	19.5501	19.8191	19.8793	19.8736	19.6966	19.0820	18.3949	17.8654	(90)
Living area fraction									FLA = Living area / (4) =			0.1160	(91)
MIT	18.0830	18.3016	18.6963	19.2289	19.6808	19.9445	20.0063	19.9997	19.8224	19.2267	18.5647	18.0550	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0830	18.3016	18.6963	19.2289	19.6808	19.9445	20.0063	19.9997	19.8224	19.2267	18.5647	18.0550	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9975	0.9946	0.9854	0.9538	0.8691	0.6950	0.4956	0.5590	0.8391	0.9740	0.9950	0.9981	(94)
Useful gains	552.7942	644.9665	745.6262	832.8769	823.3831	648.8166	441.1583	459.3055	615.4544	604.5775	540.5960	521.6824	(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	1871.8639	1815.7801	1648.6501	1381.0281	1064.8757	706.2668	450.1453	474.8380	759.0305	1151.0695	1536.1255	1864.4534	(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	981.3879	786.7868	671.8497	394.6688	179.6705	0.0000	0.0000	0.0000	0.0000	406.5900	716.7813	999.0216	(98)
Space heating												5136.7566	(98)
Space heating per m ²												(98) / (4) =	48.1601 (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

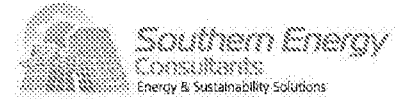
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5499.7393 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	981.3879	786.7868	671.8497	394.6688	179.6705	0.0000	0.0000	0.0000	0.0000	406.5900	716.7813	999.0216	(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)	1050.7365	842.3841	719.3252	422.5576	192.3667	0.0000	0.0000	0.0000	0.0000	435.3212	767.4318	1069.6163	(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	88.4021	88.2459	87.8745	87.0034	85.1614	80.3000	80.3000	80.3000	80.3000	86.9795	88.0266	80.3000	(216)
Fuel for water heating, kWh/month	243.1673	214.7048	226.4329	204.1701	201.9483	188.6327	180.7245	201.4655	203.6905	212.6367	222.1796	237.1344	(219)
Water heating fuel used												2536.8872	(219)
Annual totals kWh/year													
Space heating fuel - main system												5499.7393	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												441.2701	(232)
Total delivered energy for all uses												8552.8967	(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	5499.7393	0.2160	1187.9437 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2536.8872	0.2160	547.9676 (264)
Space and water heating			1735.9113 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total CO2, kg/m2/year			2003.8555 (272)
Emissions per m2 for space and water heating			16.2752 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1472 (272b)
Emissions per m2 for pumps and fans			0.3649 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2752 * 1.00) + 2.1472 + 0.3649, rounded to 2 d.p.			18.7900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			9.0000	370.1700 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16020.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.2048 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
Average = Sum(39)m / 12 =												146.2728 (39)
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.8513	30.4812	31.4538	27.4222	26.3123	22.7055	21.0400	24.1437	24.4320	28.4732	31.0807	33.7516 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	46.8431	45.3589	42.2766	38.0864	35.3659	31.5354	28.2795	32.4512	33.9334	38.2704	43.1676	45.3651	(72)
Total internal gains	403.3950	401.8842	387.6844	364.2645	339.3549	316.3212	301.9937	306.1919	318.7917	342.3584	369.4448	390.8454	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				9.1800	19.6403	0.4400	0.0000	0.7700	61.0848 (76)			
South				0.6600	46.7521	0.4400	0.0000	0.7700	10.4541 (78)			
West				6.6100	19.6403	0.4400	0.0000	0.7700	43.9837 (80)			
Solar gains	115.5227	222.6576	360.2986	518.3156	630.6927	644.0513	613.7816	529.9381	416.4594	262.3531	143.3999	95.4366 (83)
Total gains	518.9177	624.5418	747.9830	882.5801	970.0476	960.3725	915.7753	836.1300	735.2511	604.7115	512.8447	486.2820 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.9926	30.0573	30.1210	30.4239	30.4813	30.7512	30.7512	30.8017	30.6466	30.4813	30.3655	30.2454	
alpha	2.9995	3.0038	3.0081	3.0283	3.0321	3.0501	3.0501	3.0534	3.0431	3.0321	3.0244	3.0164	
util living area	0.9927	0.9867	0.9721	0.9351	0.8612	0.7393	0.6046	0.6613	0.8546	0.9622	0.9884	0.9940	(86)
MIT	18.6272	18.8617	19.2866	19.8524	20.3650	20.7364	20.8986	20.8638	20.5450	19.8614	19.1421	18.5890	(87)
Th 2	19.7701	19.7724	19.7747	19.7853	19.7873	19.7966	19.7966	19.7983	19.7930	19.7873	19.7833	19.7791	(88)
util rest of house	0.9910	0.9836	0.9652	0.9177	0.8203	0.6549	0.4719	0.5333	0.7949	0.9489	0.9852	0.9927	(89)
MIT 2	17.6169	17.8516	18.2743	18.8349	19.3193	19.6465	19.7595	19.7433	19.4980	18.8542	18.1399	17.5851	(90)
Living area fraction									FLA = Living area / (4) =			0.1160	(91)
MIT	17.7340	17.9688	18.3917	18.9529	19.4406	19.7729	19.8916	19.8732	19.6194	18.9710	18.2562	17.7015	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7340	17.9688	18.3917	18.9529	19.4406	19.7729	19.8916	19.8732	19.6194	18.9710	18.2562	17.7015	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	512.1101	610.2258	713.9557	796.3504	781.9923	627.0835	442.8457	453.5096	576.5182	566.2789	502.1845	480.9996	(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	1993.3130	1934.9413	1756.9363	1470.4809	1130.1153	748.6067	476.3533	501.8153	801.4764	1222.1620	1634.9972	1986.5834	(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	1102.0149	890.2088	775.9776	485.3739	259.0035	0.0000	0.0000	0.0000	0.0000	487.9770	815.6251	1120.1544	(98)
Space heating												5936.3353	(98)
Space heating per m ²												(98) / (4) =	55.6566 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

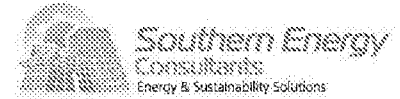


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1360.3451	1070.9099	1098.0502	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7145	0.7875	0.7492	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	971.9478	843.3223	822.6464	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1231.6172	1177.1560	1086.1829	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	186.9620	248.3722	196.0712	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												631.4054	(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	46.7405	62.0931	49.0178	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												157.8513	(107)
Space cooling per m2												1.4799	(108)
Energy for space heating												55.6566	(99)
Energy for space cooling												1.4799	(108)
Total												57.1366	(109)
Dwelling Fabric Energy Efficiency (DFEE)												57.1	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			16.4500	1.3258	21.8087		(27)
Heat Loss Floor 1			45.7700	0.1300	5.9501		(28a)
Exposed Floor Over Garage			18.4800	0.1300	2.4024		(28b)
Brick Cavity	127.2500	16.4800	110.7700	0.1800	19.9386		(29a)
Solid Garage Wall	19.5500		19.5500	0.1800	3.5190		(29a)
Clad Cavity	12.0600	2.1200	9.9400	0.1800	1.7892		(29a)
Main Plane	60.8900		60.8900	0.1300	7.9157		(30)
Porch Roof	4.7800		4.7800	0.1300	0.6214		(30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5251		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.9154 (36)
Total fabric heat loss						(33) + (36) =	84.4405 (37)

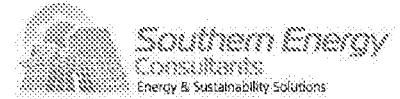
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Average = Sum(39)m / 12 =	135.8094	135.4898	135.1766	133.7056	133.4303	132.1490	132.1490	131.9118	132.6426	133.4303	133.9871	134.5692 (39)
												133.7042 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2733	1.2703	1.2674	1.2536	1.2510	1.2390	1.2390	1.2368	1.2436	1.2510	1.2562	1.2617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7932 (42)
Average daily hot water use (litres/day)												100.5390 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(59)
Heat gains from water heating, kWh/month	34.8513	30.4812	31.4538	27.4222	26.3123	22.7055	21.0400	24.1437	24.4320	28.4732	31.0807	33.7516 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	139.6610	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9865	22.1928	18.0484	13.6638	10.2139	8.6230	9.3174	12.1111	16.2555	20.6402	24.0901	25.6810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.6671	269.4342	262.4611	247.6160	228.8768	211.2645	199.4985	196.7313	203.7045	218.5495	237.2888	254.9010	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	36.9661	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	46.8431	45.3589	42.2766	38.0864	35.3659	31.5354	28.2795	32.4512	33.9334	38.2704	43.1676	45.3651	(72)
Total internal gains	403.3950	401.8842	387.6844	364.2645	339.3549	316.3212	301.9937	306.1919	318.7917	342.3584	369.4448	390.8454	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East	9.1800	19.6403	0.6300		0.7000	0.7700	55.1013	(76)
South	0.6600	46.7521	0.6300		0.7000	0.7700	9.4301	(78)
West	6.6100	19.6403	0.6300		0.7000	0.7700	39.6753	(80)

Solar gains	104.2067	200.8473	325.0057	467.5443	568.9135	580.9636	553.6589	478.0282	375.6653	236.6544	129.3532	86.0882	(83)
Total gains	507.6018	602.7315	712.6901	831.8088	908.2684	897.2847	855.6526	784.2201	694.4570	579.0128	498.7980	476.9335	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5393	54.6679	54.7946	55.3974	55.5117	56.0499	56.0499	56.1507	55.8414	55.5117	55.2810	55.0419	
alpha	4.6360	4.6445	4.6530	4.6932	4.7008	4.7367	4.7367	4.7434	4.7228	4.7008	4.6854	4.6695	
util living area	0.9992	0.9982	0.9942	0.9781	0.9256	0.8004	0.6403	0.7065	0.9175	0.9904	0.9985	0.9994	(86)
MIT	19.4836	19.6388	19.9211	20.3050	20.6540	20.8895	20.9709	20.9543	20.7593	20.2960	19.8214	19.4604	(87)
Th 2	19.8618	19.8642	19.8665	19.8774	19.8794	19.8889	19.8889	19.8907	19.8853	19.8794	19.8753	19.8710	(88)
util rest of house	0.9990	0.9975	0.9920	0.9686	0.8910	0.7097	0.4976	0.5668	0.8638	0.9849	0.9978	0.9993	(89)
MIT 2	18.4785	18.6352	18.9183	19.3052	19.6355	19.8351	19.8813	19.8769	19.7402	19.3019	18.8266	18.4624	(90)
Living area fraction									fLA = Living area / (4) =			0.1160	(91)
MIT	18.5950	18.7516	19.0346	19.4212	19.7536	19.9574	20.0077	20.0018	19.8584	19.4172	18.9420	18.5781	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5950	18.7516	19.0346	19.4212	19.7536	19.9574	20.0077	20.0018	19.8584	19.4172	18.9420	18.5781	(93)

8. Space heating requirement

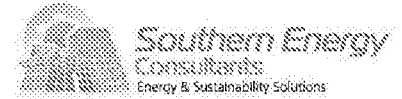
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9965	0.9896	0.9635	0.8861	0.7161	0.5141	0.5824	0.8621	0.9815	0.9970	0.9989	(94)
Ext temp.	506.8549	600.6348	705.2925	801.4092	804.8407	642.5546	439.8579	456.7036	598.6879	568.3283	497.2848	476.4138	(95)
Heat loss rate 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)
1941.3992	1876.7552	1694.3861	1406.7407	1074.5950	707.9729	450.3204	475.1238	763.8119	1176.4852	1586.6741	1934.8559		(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1067.3010	857.5529	735.8856	435.8387	200.6972	0.0000	0.0000	0.0000	0.0000	452.4688	784.3603	1085.0809	(98)
Space heating												5619.1855	(98)
Space heating per m ²												52.6832	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1242.2010	977.9029	1002.5294	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7955	0.8726	0.8351	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	988.1119	853.3421	837.2233	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1157.8782	1106.8827	1025.5090	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

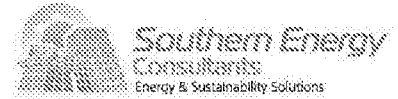


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	122.2318	188.6342	140.0846	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												450.9506 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
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 (107)
Space cooling per m2												112.7377 (107)
Energy for space heating												1.0570 (108)
Energy for space cooling												52.6832 (99)
Total												1.0570 (108)
Target Fabric Energy Efficiency (TFEE)												53.7401 (109)
												61.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3597	0.3425	0.3425	0.3169	0.3169	0.2826	0.2912	0.2740	0.2826	0.2997	0.2997	0.3254 (22b)
Effective ac	0.5647	0.5587	0.5587	0.5502	0.5502	0.5399	0.5424	0.5375	0.5399	0.5449	0.5449	0.5529 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7209	48.2021	48.2021	47.4713	47.4713	46.5854	46.7974	46.3798	46.5854	47.0157	47.0157	47.7085 (38)
Heat transfer coeff	145.7299	145.2111	145.2111	144.4803	144.4803	143.5945	143.8064	143.3888	143.5945	144.0247	144.0247	144.7176 (39)
Average = Sum(39)m / 12 =												144.3553 (39)
HLP	1.3663	1.3614	1.3614	1.3546	1.3546	1.3463	1.3483	1.3444	1.3463	1.3503	1.3503	1.3568 (40)
HLP (average)												1.3534 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

Regs Region: England

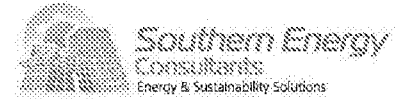
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
Water storage loss:	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (64)
RHI water heating demand												1748 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336	(72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East				9.1800	22.3313		0.4400	0.0000	0.7700	69.4545 (76)		
South				0.6600	50.9848		0.4400	0.0000	0.7700	11.4006 (78)		
West				6.6100	22.3313		0.4400	0.0000	0.7700	50.0103 (80)		
Solar gains	130.8654	226.9719	362.4031	536.1932	634.7309	693.3062	653.7121	577.7931	453.7066	285.4664	166.4343	107.0534 (83)
Total gains	782.8097	873.7354	983.5664	1117.6682	1175.3438	1197.6475	1137.1254	1070.6023	969.6116	841.2895	766.5279	740.8556 (84)

7. Mean internal temperature (heating season)

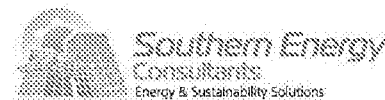
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	31.2431	31.3548	31.3548	31.5134	31.5134	31.7078	31.6610	31.7532	31.7078	31.6130	31.6130	31.4617		
alpha	3.0829	3.0903	3.0903	3.1009	3.1009	3.1139	3.1107	3.1169	3.1139	3.1075	3.1075	3.0974		
util living area	0.9764	0.9659	0.9382	0.8720	0.7498	0.5439	0.3788	0.4106	0.6967	0.8994	0.9622	0.9795	(86)	
MIT	19.1393	19.3296	19.7378	20.2439	20.6700	20.9198	20.9819	20.9768	20.8105	20.2816	19.6348	19.1078	(87)	
Th 2	19.7893	19.7930	19.7930	19.7983	19.7983	19.8048	19.8032	19.8063	19.8048	19.8016	19.8016	19.7966	(88)	
util rest of house	0.9710	0.9581	0.9234	0.8401	0.6846	0.4338	0.2385	0.2654	0.5989	0.8667	0.9520	0.9748	(89)	
MIT 2	17.3662	17.6425	18.2267	18.9337	19.4858	19.7574	19.7988	19.8000	19.6627	19.0050	18.0924	17.3255	(90)	
Living area fraction									fLA = Living area / (4) =			0.1160	(91)	
MIT	17.5719	17.8382	18.4020	19.0857	19.6232	19.8922	19.9360	19.9365	19.7958	19.1530	18.2713	17.5322	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	17.4219	17.6882	18.2520	18.9357	19.4732	19.7422	19.7860	19.7865	19.6458	19.0030	18.1213	17.3822	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9549	0.9383	0.8975	0.8114	0.6641	0.4275	0.2364	0.2629	0.5838	0.8376	0.9307	0.9601	(94)	
Ext temp.	747.4683	819.8129	882.7657	906.8221	780.5940	511.9954	268.8277	281.4573	566.0922	704.6781	713.4211	711.3078	(95)	
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)	
Month fracti	1795.6654	1755.3337	1575.8275	1305.4789	935.2436	537.3595	271.2256	284.8447	638.3985	1066.2216	1457.7112	1777.4488	(97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
RHI space heating demand	779.8587	628.6700	515.6380	287.0329	115.0593	0.0000	0.0000	0.0000	0.0000	268.9883	535.8889	793.2088	(98)	
												3924.3451	(98)	

FULL SAP CALCULATION PRINTOUT

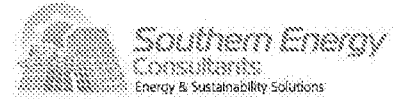
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Average = Sum(39)m / 12 =	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7932 (42)
Average daily hot water use (litres/day)												100.5390 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

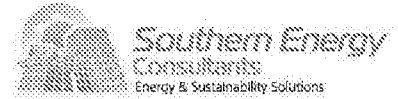
**Southern Energy
Consultants**
Energy & Sustainability Solutions

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929	(44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311	(45)
Distribution loss	(46)m =	0.15 x	(45)m							Total =	Sum(45)m =	1581.8696	(45)
Water storage loss:	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247	(46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378	(61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9616	0.9450	0.9112	0.8436	0.7323	0.5672	0.3989	0.4458	0.6857	0.8737	0.9445	0.9663 (94)
Useful gains	737.9818	821.5646	894.3366	927.7507	857.7607	651.3561	437.6873	455.8990	639.3291	714.8015	702.1936	704.6960 (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												
Month fracti	1905.1581	1857.6389	1697.4102	1431.6581	1104.6771	728.2442	455.7018	481.7665	782.2212	1187.9109	1571.4238	1896.1815 (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)
	868.3792	696.2419	597.4868	362.8133	183.7058	0.0000	0.0000	0.0000	0.0000	351.9934	625.8457	886.4652 (98)
Space heating												4572.9313 (99)
Space heating per m2												42.8739 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)												
Fraction of space heat from main system(s)	1.0000 (202)												
Efficiency of main space heating system 1 (in %)	90.5000 (206)												
Efficiency of secondary/supplementary heating system, %	0.0000 (208)												
Space heating requirement	5052.9627 (211)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	868.3792	696.2419	597.4868	362.8133	183.7058	0.0000	0.0000	0.0000	0.0000	351.9934	625.8457	886.4652	(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)	959.5350	769.3280	660.2064	400.8987	202.9898	0.0000	0.0000	0.0000	0.0000	388.9430	691.5422	979.5196	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)
Efficiency of water heater (217)m	89.9388	89.8962	89.7975	89.5733	89.0998	87.3000	87.3000	87.3000	87.3000	89.5283	89.8298	89.9616	(216)
Fuel for water heating, kWh/month	198.0861	173.7674	180.5505	159.2702	154.7251	137.9085	129.4194	146.1988	147.2610	165.3885	178.0320	192.2696	(219)
Water heating fuel used	1962.8772 (219)												
Annual totals kWh/year													
Space heating fuel - main system	5052.9627 (211)												
Space heating fuel - secondary	0.0000 (215)												
Electricity for pumps and fans:													
central heating pump	30.0000 (230c)												
main heating flue fan	45.0000 (230e)												
Total electricity for the above, kWh/year	75.0000 (231)												
Electricity for lighting (calculated in Appendix L)	441.2701 (232)												
Total delivered energy for all uses	7532.1100 (238)												

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5052.9627	3.4800	175.8431 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1962.8772	3.4800	68.3081 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	441.2701	13.1900	58.2035 (250)
Additional standing charges			120.0000 (251)
Total energy cost			432.2473 (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] = 1.1970 (257)
SAP value	83.3012
SAP rating (Section 12)	B (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5052.9627	0.2160	1091.4399 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1962.8772	0.2160	423.9815 (264)
Space and water heating			1515.4214 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total kg/year			1783.3656 (272)
CO2 emissions per m2			16.7200 (273)
EI value			84.2430
EI rating			B (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8890 = 3.914$, stars = 4
Water heating environmental impact	$0.216 / 0.8890 = 0.2430$, stars = 4

Regs Region: England

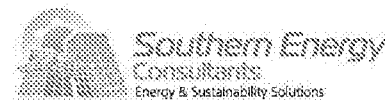
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7209	48.2021	48.2021	47.4713	47.4713	46.5854	46.7974	46.3798	46.5854	47.0157	47.0157	47.7085 (38)
Heat transfer coeff	145.7299	145.2111	145.2111	144.4803	144.4803	143.5945	143.8064	143.3888	143.5945	144.0247	144.0247	144.7176 (39)
Average = Sum(39)m / 12 =												144.3553 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3663	1.3614	1.3614	1.3546	1.3546	1.3463	1.3483	1.3444	1.3463	1.3503	1.3503	1.3568 (40)
HLP (average)												1.3534 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

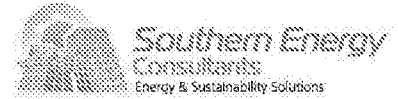
**Southern Energy
Consultants**
Energy & Sustainability Solutions

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929	(44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311	(45)
Distribution loss	(46)m =	0.15 x	(45)m							Total =	Sum(45)m =	1581.8696	(45)
Water storage loss:	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247	(46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378	(61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9549	0.9383	0.8975	0.8114	0.6641	0.4275	0.2364	0.2629	0.5838	0.8376	0.9307	0.9601 (94)
Useful gains	747.4683	819.8129	882.7657	906.8221	780.5940	511.9954	268.8277	281.4573	566.0922	704.6781	713.4211	711.3078 (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	1795.6654	1755.3337	1575.8275	1305.4789	935.2436	537.3595	271.2256	284.8447	638.3985	1066.2216	1457.7112	1777.4488 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000 (97a)
Space heating kWh	779.8587	628.6700	515.6380	287.0329	115.0593	0.0000	0.0000	0.0000	0.0000	268.9883	535.8889	793.2088 (98)
Space heating												3924.3451 (98)
Space heating per m2												36.7930 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4336.2929	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	779.8587	628.6700	515.6380	287.0329	115.0593	0.0000	0.0000	0.0000	0.0000	268.9883	535.8889	793.2088	(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)	861.7223	694.6630	569.7658	317.1634	127.1374	0.0000	0.0000	0.0000	0.0000	297.2247	592.1425	876.4739	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688	(64)	
Efficiency of water heater (217)m	89.8873	89.8446	89.7134	89.4119	88.7272	87.3000	87.3000	87.3000	87.3000	89.3374	89.7439	89.9100	(216)	
Fuel for water heating, kWh/month	198.1996	173.8673	180.7198	159.5578	155.3748	137.9085	129.4194	146.1988	147.2610	165.7419	178.2024	192.3800	(219)	
Water heating fuel used												1964.8313	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4336.2929	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													441.2701	(232)
Total delivered energy for all uses													6817.3943	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4336.2929	3.8700	167.8145 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.8313	3.8700	76.0390 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	441.2701	18.9000	83.4000 (250)
Additional standing charges			93.0000 (251)
Total energy cost			434.4286 (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	4336.2929	0.2160	936.6393 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.8313	0.2160	424.4036 (264)
Space and water heating			1361.0428 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Total kg/year			1628.9870 (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	4336.2929	1.2200	5290.2773 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.8313	1.2200	2397.0942 (264)
Space and water heating			7687.3715 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	441.2701	3.0700	1354.6992 (268)
Primary energy kWh/year			9272.3207 (272)
Primary energy kWh/m2/year			86.9334 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 83

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 84

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 29	-191 kg (11.7%)
U Solar photovoltaic panels	+ 8.8	-£ 345	-947 kg (65.8%)

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

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

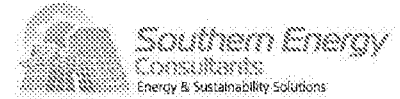
Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£98	£107	-£9
Mains gas	£337	£298	£39
Space heating	£275	£275	£0
Water heating	£76	£47	£29
Lighting	£83	£83	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£435	£60	£375
Total cost of uses	£434	£60	£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	24 kWh/m²	63 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4367	0.4282	0.4196	0.3768	0.3682	0.3254	0.3254	0.3169	0.3425	0.3682	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5880	0.5710	0.5678	0.5529	0.5529	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.3689	51.0493	50.7361	49.2650	48.9898	47.7085	47.7085	47.4713	48.2021	48.9898	49.5466	50.1287 (38)
Heat transfer coeff	148.3779	148.0584	147.7452	146.2741	145.9988	144.7176	144.7176	144.4803	145.2111	145.9988	146.5556	147.1377 (39)
Average = Sum(39)m / 12 =												146.2728 (39)
HLP	1.3911	1.3881	1.3852	1.3714	1.3688	1.3568	1.3568	1.3546	1.3614	1.3688	1.3740	1.3795 (40)
HLP (average)												1.3714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1465 (H8)
Utilisation factor												0.5820 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5390 (H14)
Volume ratio Veff/V												0.7460 (H15)
Solar storage volume factor												0.9414 (H16)
Solar input												-873.6802 (H17)
Solar input	-25.3350	-42.2768	-72.0022	-96.4972	-119.2142	-117.2065	-115.6576	-101.0506	-79.1429	-54.0453	-30.0509	-21.2011 (63)
								Solar input (sum of months) = Sum(63)m =				-873.6802 (63)
Output from w/h	152.8212	113.9335	90.1275	46.1664	18.6456	3.1876	0.0000	26.5809	49.4160	94.0242	129.8749	151.7678 (64)
								Total per year (kWh/year) = Sum(64)m =				876.5457 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336	(72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF	Access factor Table 6d	Gains W
East	9.1800	19.6403	0.4400		0.0000	0.7700	61.0848 (76)
South	0.6600	46.7521	0.4400		0.0000	0.7700	10.4541 (78)
West	6.6100	19.6403	0.4400		0.0000	0.7700	43.9837 (80)

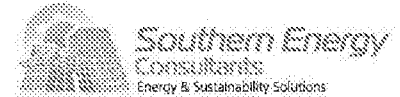
Solar gains	115.5227	222.6576	360.2986	518.3156	630.6927	644.0513	613.7816	529.9381	416.4594	262.3531	143.3999	95.4366 (83)
Total gains	767.4670	869.4211	981.4619	1099.7907	1171.3056	1148.3925	1097.1949	1022.7473	932.3644	818.1762	743.4934	729.2389 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.6856	30.7518	30.8170	31.1269	31.1856	31.4617	31.4617	31.5134	31.3548	31.1856	31.0671	30.9442
alpha	3.0457	3.0501	3.0545	3.0751	3.0790	3.0974	3.0974	3.1009	3.0903	3.0790	3.0711	3.0629
util living area												
	0.9804	0.9702	0.9479	0.8976	0.8075	0.6696	0.5298	0.5777	0.7820	0.9253	0.9708	0.9831 (86)
MIT	18.9450	19.1643	19.5544	20.0633	20.5066	20.8112	20.9333	20.9114	20.6726	20.0883	19.4268	18.9039 (87)
Th 2	19.7701	19.7724	19.7747	19.7853	19.7873	19.7966	19.7966	19.7983	19.7930	19.7873	19.7833	19.7791 (88)
util rest of house												
	0.9761	0.9636	0.9358	0.8727	0.7579	0.5809	0.4043	0.4531	0.7084	0.9018	0.9631	0.9794 (89)
MIT 2	17.0728	17.3910	17.9531	18.6767	19.2733	19.6472	19.7632	19.7498	19.5009	18.7288	17.7816	17.0185 (90)
Living area fraction												
MIT	17.2899	17.5967	18.1388	18.8375	19.4163	19.7822	19.8989	19.8845	19.6368	18.8864	17.9724	17.2371 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1399	17.4467	17.9888	18.6875	19.2663	19.6322	19.7489	19.7345	19.4868	18.7364	17.8224	17.0871 (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	0.9616	0.9450	0.9112	0.8436	0.7323	0.5672	0.3989	0.4458	0.6857	0.8737	0.9445	0.9663	(94)
Useful gains	737.9818	821.5646	894.3366	927.7507	857.7607	651.3561	437.6873	455.8990	639.3291	714.8015	702.1936	704.6960	(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	1905.1581	1857.6389	1697.4102	1431.6581	1104.6771	728.2442	455.7018	481.7665	782.2212	1187.9109	1571.4238	1896.1815	(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	868.3792	696.2419	597.4868	362.8133	183.7058	0.0000	0.0000	0.0000	0.0000	351.9934	625.8457	886.4652	(98)
Space heating												4572.9313	(98)
Space heating per m2											(98) / (4) =	42.8739	(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													5052.9627 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	868.3792	696.2419	597.4868	362.8133	183.7058	0.0000	0.0000	0.0000	0.0000	351.9934	625.8457	886.4652	(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)	959.5350	769.3280	660.2064	400.8987	202.9898	0.0000	0.0000	0.0000	0.0000	388.9430	691.5422	979.5196	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	152.8212	113.9335	90.1275	46.1664	18.6456	3.1876	0.0000	26.5809	49.4160	94.0242	129.8749	151.7678	(64)
Efficiency of water heater (217)m	90.0063	90.0359	90.0673	90.1271	90.1954	87.3000	87.3000	87.3000	87.3000	89.8060	89.9335	90.0177	(216)
Fuel for water heating, kWh/month	169.7895	126.5423	100.0669	51.2237	20.6725	3.6514	0.0000	30.4478	56.6048	104.6970	144.4122	168.5978	(219)
Water heating fuel used												976.7058	(219)
Annual totals kWh/year													
Space heating fuel - main system												5052.9627	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												441.2701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												4868.6992	(238)

10a. Fuel costs - using Table 12 prices

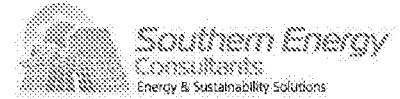
	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	5052.9627	3.4800	175.8431	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	976.7058	3.4800	33.9894	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	441.2701	13.1900	58.2035	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			176.7006	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4893	(257)
SAP value		93.1736	
SAP rating (Section 12)		93	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5052.9627	0.2160	1091.4399 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	976.7058	0.2160	210.9685 (264)
Space and water heating			1302.4084 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	441.2701	0.5190	229.0192 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			699.8653 (272)
CO2 emissions per m2			6.5600 (273)
EI value			93.8163
EI rating			94 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7700 (1b)	x 2.3200 (2b)	= 106.1864 (1b) - (3b)
First floor	60.8900 (1c)	x 2.5500 (2c)	= 155.2695 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.4559 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3597	0.3425	0.3425	0.3169	0.3169	0.2826	0.2912	0.2740	0.2826	0.2997	0.2997	0.3254 (22b)
Effective ac	0.5647	0.5587	0.5587	0.5502	0.5502	0.5399	0.5424	0.5375	0.5399	0.5449	0.5449	0.5529 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			16.4500	1.2357	20.3279		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.7700	0.2000	9.1540	75.0000	3432.7500 (28a)
Exposed Floor Over Garage			18.4800	0.1838	3.3959	20.0000	369.6000 (28b)
Brick Cavity	127.2500	16.4800	110.7700	0.2500	27.6925	60.0000	6646.2000 (29a)
Solid Garage Wall	19.5500		19.5500	0.4056	7.9287	9.0000	175.9500 (29a)
Clad Cavity	12.0600	2.1200	9.9400	0.2400	2.3856	60.0000	596.4000 (29a)
Main Plane	60.8900		60.8900	0.1100	6.6979	9.0000	548.0100 (30)
Porch Roof	4.7800		4.7800	0.1100	0.5258	9.0000	43.0200 (30)
Total net area of external elements Aum(A, m ²)			288.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5484		(33)
Internal Wall 1			19.4900			75.0000	1461.7500 (32c)
Internal Wall 2			181.8500			9.0000	1636.6500 (32c)
Internal Floor 1			41.1300			18.0000	740.3400 (32d)
Internal Ceiling 1			41.1300			18.0000	740.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16391.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6753 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4607 (36)
Total fabric heat loss						(33) + (36) =	97.0090 (37)

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

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

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

4. Water heating energy requirements (kWh/year)

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

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

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 FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	110.5929	106.5713	102.5498	98.5282	94.5066	90.4851	90.4851	94.5066	98.5282	102.5498	106.5713	110.5929 (44)
Energy content (annual)	164.0060	143.4407	148.0180	129.0457	123.8224	106.8493	99.0116	113.6172	114.9742	133.9913	146.2620	158.8311 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1581.8696 (45)
	24.6009	21.5161	22.2027	19.3568	18.5734	16.0274	14.8517	17.0426	17.2461	20.0987	21.9393	23.8247 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1502	12.7695	14.1118	13.6180	14.0374	13.5448	13.9716	14.0143	13.5847	14.0781	13.6638	14.1378 (61)
Total heat required for water heating calculated for each month	178.1562	156.2103	162.1298	142.6636	137.8598	120.3941	112.9832	127.6315	128.5589	148.0695	159.9259	172.9688 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2108 (H8)
Utilisation factor												0.5622 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5390 (H14)
Volume ratio Veff/V												0.7460 (H15)
Solar storage volume factor												0.9414 (H16)
Solar input												-891.2684 (H17)
Solar input	-27.4328	-41.2314	-69.4390	-95.9859	-115.5993	-121.6632	-118.7419	-106.0372	-82.7624	-56.3017	-33.3453	-22.7282 (63)
								Solar input (sum of months) =	Sum(63)m =			-891.2684 (63)
Output from w/h	150.7234	114.9788	92.6908	46.6777	22.2605	0.0000	0.0000	21.5943	45.7965	91.7678	126.5806	150.2406 (64)
								Total per year (kWh/year) =	Sum(64)m =			863.3110 (64)
Heat gains from water heating, kWh/month	58.0696	50.8864	52.7439	46.3122	44.6803	38.9136	36.4142	41.2813	41.6251	48.0717	52.0481	56.3458 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	167.5932	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.4663	55.4821	45.1210	34.1595	25.5346	21.5574	23.2936	30.2779	40.6389	51.6004	60.2253	64.2025	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.0106	402.1407	391.7329	369.5761	341.6071	315.3202	297.7589	293.6288	304.0365	326.1933	354.1623	380.4493	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	54.5525	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	-111.7288	(71)
Water heating gains (Table 5)	78.0505	75.7239	70.8924	64.3225	60.0542	54.0467	48.9439	55.4856	57.8126	64.6124	72.2890	75.7336	(72)
Total internal gains	651.9443	646.7635	621.1633	581.4750	540.6129	504.3412	483.4133	492.8092	515.9050	555.8231	600.0936	633.8023	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				9.1800	22.3313		0.4400		0.0000		0.7700		69.4545 (76)
South				0.6600	50.9848		0.4400		0.0000		0.7700		11.4006 (78)
West				6.6100	22.3313		0.4400		0.0000		0.7700		50.0103 (80)
Solar gains	130.8654	226.9719	362.4031	536.1932	634.7309	693.3062	653.7121	577.7931	453.7066	285.4664	166.4343		107.0534 (83)
Total gains	782.8097	873.7354	983.5664	1117.6682	1175.3438	1197.6475	1137.1254	1070.6023	969.6116	841.2895	766.5279		740.8556 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.2431	31.3548	31.3548	31.5134	31.5134	31.7078	31.6610	31.7532	31.7078	31.6130	31.6130	31.4617
alpha	3.0829	3.0903	3.0903	3.1009	3.1009	3.1139	3.1107	3.1169	3.1139	3.1075	3.1075	3.0974
util living area	0.9764	0.9659	0.9382	0.8720	0.7498	0.5439	0.3788	0.4106	0.6967	0.8994	0.9622	0.9795 (86)
MIT	19.1393	19.3296	19.7378	20.2439	20.6700	20.9198	20.9819	20.9768	20.8105	20.2816	19.6348	19.1078 (87)
Th 2	19.7893	19.7930	19.7930	19.7983	19.7983	19.8048	19.8032	19.8063	19.8048	19.8016	19.8016	19.7966 (88)
util rest of house	0.9710	0.9581	0.9234	0.8401	0.6846	0.4338	0.2385	0.2654	0.5989	0.8667	0.9520	0.9748 (89)
MIT 2	17.3662	17.6425	18.2267	18.9337	19.4858	19.7574	19.7988	19.8000	19.6627	19.0050	18.0924	17.3255 (90)
Living area fraction												
MIT	17.5719	17.8382	18.4020	19.0857	19.6232	19.8922	19.9360	19.9365	19.7958	19.1530	18.2713	17.5322 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4219	17.6882	18.2520	18.9357	19.4732	19.7422	19.7860	19.7865	19.6458	19.0030	18.1213	17.3822 (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	0.9549	0.9383	0.8975	0.8114	0.6641	0.4275	0.2364	0.2629	0.5838	0.8376	0.9307	0.9601	(94)
Useful gains	747.4683	819.8129	882.7657	906.8221	780.5940	511.9954	268.8277	281.4573	566.0922	704.6781	713.4211	711.3078	(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	1795.6654	1755.3337	1575.8275	1305.4789	935.2436	537.3595	271.2256	284.8447	638.3985	1066.2216	1457.7112	1777.4488	(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	779.8587	628.6700	515.6380	287.0329	115.0593	0.0000	0.0000	0.0000	0.0000	268.9883	535.8889	793.2088	(98)
Space heating												3924.3451	(98)
Space heating per m2											(98) / (4) =	36.7930	(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													4336.2929	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	779.8587	628.6700	515.6380	287.0329	115.0593	0.0000	0.0000	0.0000	0.0000	268.9883	535.8889	793.2088	(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)	861.7223	694.6630	569.7658	317.1634	127.1374	0.0000	0.0000	0.0000	0.0000	297.2247	592.1425	876.4739	(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	89.9659	89.9900	89.9974	90.0384	89.9654	87.3000	87.3000	87.3000	87.3000	89.6640	89.8706	89.9748	(216)	
(217)m	89.9659	89.9900	89.9974	90.0384	89.9654	87.3000	87.3000	87.3000	87.3000	89.6640	89.8706	89.9748	(217)	
Fuel for water heating, kWh/month	167.5340	127.7685	102.9928	51.8420	24.7434	0.0000	0.0000	24.7357	52.4587	102.3463	140.8477	166.9808	(219)	
Water heating fuel used												962.2499	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4336.2929	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													441.2701	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)	
Total delivered energy for all uses												4040.6532	(238)	

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

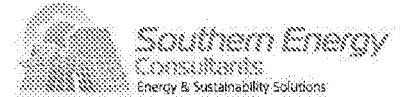
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4336.2929	3.8700	167.8145	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	962.2499	3.8700	37.2391	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	441.2701	18.9000	83.4000	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			60.3125	(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	4336.2929	0.2160	936.6393	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	962.2499	0.2160	207.8460	(264)
Space and water heating			1144.4852	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	441.2701	0.5190	229.0192	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			491.6406 (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	4336.2929	1.2200	5290.2773 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.2499	1.2200	1173.9449 (264)
Space and water heating			6464.2222 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	441.2701	3.0700	1354.6992 (268)

Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2602.5013 (272)
Primary energy kWh/m2/year			24.4000 (273)

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

Overheating Calculation Input Data

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

Overheating Calculation

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

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.1800	117.5071	0.4400	0.0000	0.9000	427.1711
South	0.6600	112.2060	0.4400	0.0000	0.9000	29.3262
West	6.6100	117.5071	0.4400	0.0000	0.9000	307.5818
total:						764.0791

	Jun	Jul	Aug	
Solar gains	810	764	675	(P4)
Internal gains	501	480	490	
Total summer gains	1312	1244	1165	(P5)
Summer gain/loss ratio	2.97	2.81	2.64	(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	19.89	21.64	21.36	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			