

FULL SAP CALCULATION PRINTOUT

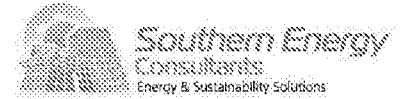
Calculation Type: New Build (As Designed)



Property Reference	SECANG007			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	2B3P, Plot 67,75				
SAP Rating	83 B	DER	19.05	TET	19.56
Environmental	36 B	% DER<TER	2.60		
CO ₂ Emissions (t/year)	1.14	DREE	51.38	TTEE	54.59
General Requirements Compliance	Pass	% DPEE<TTEE	5.90		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 73 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) 19.56 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.09 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

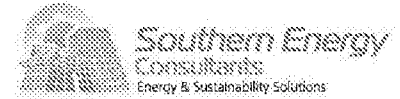
Overshading: Average
Windows facing North: 1.79 m², No overhang
Windows facing East: 3.58 m², No overhang
Windows facing West: 3.24 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

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

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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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1635 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4135 (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) =		0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				15847.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =				54.3873 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

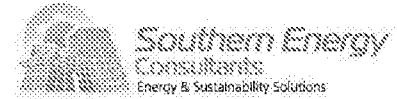
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
	Total per year (kWh/year) = Sum(64)m =											1570.8557 (64)	
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	355.7994	353.5767	340.5500	319.7413	298.7517	278.5962	265.5942	271.5575	282.3542	303.3671	327.3895	345.2725	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W
North				1.7900	10.6334	0.4400	0.0000				0.7700	6.4486 (74)
East				3.5800	19.6403	0.4400	0.0000				0.7700	23.8218 (76)
West				3.2400	19.6403	0.4400	0.0000				0.7700	21.5594 (80)
Solar gains	51.8297	101.0988	167.1409	246.8604	306.6253	316.0085	299.9598	254.6896	195.2143	120.0088	64.5401	42.6951 (83)
Total gains	407.6292	454.6755	507.6909	566.6016	605.3770	594.6047	565.5540	526.2471	477.5686	423.3759	391.9297	387.9676 (84)

7. Mean internal temperature (heating season)

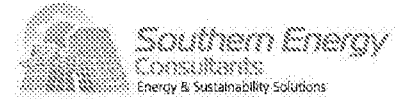
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.5150	48.6416	48.7663	49.3606	49.4734	50.0054	50.0054	50.1052	49.7992	49.4734	49.2457	49.0099
alpha	4.2343	4.2428	4.2511	4.2907	4.2982	4.3337	4.3337	4.3403	4.3199	4.2982	4.2830	4.2673
util living area	0.9972	0.9951	0.9890	0.9690	0.9134	0.7900	0.6366	0.6930	0.8964	0.9809	0.9951	0.9977 (86)
MIT	19.4373	19.5832	19.8615	20.2498	20.6112	20.8670	20.9612	20.9440	20.7420	20.2776	19.7941	19.4149 (87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989 (88)
util rest of house	0.9963	0.9935	0.9853	0.9577	0.8788	0.7050	0.5018	0.5621	0.8406	0.9719	0.9933	0.9971 (89)
MIT 2	17.8075	18.0222	18.4290	18.9960	19.4966	19.8164	19.9011	19.8923	19.6806	19.0437	18.3389	17.7814 (90)
Living area fraction	18.1013	18.3036	18.6872	19.2220	19.6975	20.0058	20.0922	20.0818	19.8719	19.2661	18.6012	18.0758 (91)
MIT	17.9513	18.1536	18.5372	19.0720	19.5475	19.8558	19.9422	19.9318	19.7219	19.1161	18.4512	17.9258 (92)
Temperature adjustment												-0.1500
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	405.1500	450.0411	496.8436	535.8203	523.2089	415.7623	285.6502	296.6274	395.3474	407.3377	387.8126	386.0493	(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	1238.7032	1199.4878	1086.6169	907.1827	698.2818	462.6894	294.2276	310.3016	496.9732	757.7686	1014.7134	1232.8916	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	620.1636	503.6282	438.7914	267.3809	130.2543	0.0000	0.0000	0.0000	0.0000	260.7206	451.3686	630.0507	(98)
Space heating												3302.3583	(98)
Space heating per m2												45.0895	(99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3649.0147	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	620.1636	503.6282	438.7914	267.3809	130.2543	0.0000	0.0000	0.0000	0.0000	260.7206	451.3686	630.0507	(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)	685.2636	556.4953	484.8523	295.4486	143.9274	0.0000	0.0000	0.0000	0.0000	288.0890	498.7498	696.1887	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)	
Efficiency of water heater (217)m	89.8252	89.7834	89.6810	89.4373	88.9104	87.3000	87.3000	87.3000	87.3000	89.3926	89.7064	89.8489	(217)	
Fuel for water heating, kWh/month	177.9631	156.1466	162.3429	143.3845	139.4907	124.2327	116.7468	131.6541	132.5400	148.8913	160.0714	172.7855	(219)	
Water heating fuel used												1766.2495	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3649.0147	(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)													359.4216	(232)
Total delivered energy for all uses													5849.6858	(238)

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

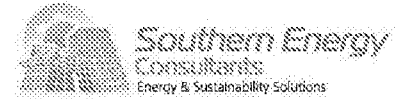
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3649.0147	0.2160	788.1872 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1766.2495	0.2160	381.5099 (264)
Space and water heating			1169.6971 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total CO2, kg/year			1395.1619 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.0500 (273)

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

DER		19.0500	ZC1
Total Floor Area	TFA	73.2400	
Assumed number of occupants	N	2.3221	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5652	ZC2
CO2 emissions from cooking, equation (L16)		2.3857	ZC3
Total CO2 emissions		38.0009	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		38.0009	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1500	1.0000	2.1500			(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800			(26a)					
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148			(27)					
Heat Loss Floor 1			36.6200	0.1300	4.7606			(28a)					
Brick Cavity	85.6700	12.9100	72.7600	0.1800	13.0968			(29a)					
External Roof 1	36.6200		36.6200	0.1300	4.7606			(30)					
Total net area of external elements Aum(A, m2)			158.9100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7628			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0489	(36)					
Total fabric heat loss						(33) + (36) =	47.8117	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 36.3517	Feb 36.1156	Mar 35.8842	Apr 34.7973	May 34.5939	Jun 33.6472	Jul 33.6472	Aug 33.4719	Sep 34.0119	Oct 34.5939	Nov 35.0053	Dec 35.4354	(38)
Heat transfer coeff	84.1634	83.9273	83.6959	82.6089	82.4056	81.4589	81.4589	81.2836	81.8236	82.4056	82.8170	83.2471	(39)
Average = Sum(39)m / 12 =												82.6080	(39)
HLP	Jan 1.1491	Feb 1.1459	Mar 1.1428	Apr 1.1279	May 1.1251	Jun 1.1122	Jul 1.1122	Aug 1.1098	Sep 1.1172	Oct 1.1251	Nov 1.1308	Dec 1.1366	(40)
HLP (average)												1.1279	(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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)
Energy content (annual)										Total = Sum(45)m =		1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.0855	43.5935	46.4429	43.1822	42.8003	39.6571	40.9791	42.8003	43.1822	46.4429	46.7073	50.0855			(61)
Total heat required for water heating calculated for each month	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419			(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	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419			(64)
Heat gains from water heating, kWh/month	60.9851	53.2850	55.3499	48.9285	47.2895	41.4882	39.5026	44.2739	44.7704	51.2051	54.8972	59.4559			(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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073			(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176			(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043			(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107			(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859			(71)
Water heating gains (Table 5)	81.9692	79.2932	74.3951	67.9562	63.5612	57.6225	53.0949	59.5079	62.1811	68.8240	76.2461	79.9138			(72)
Total internal gains	367.8912	365.0642	351.4367	330.0289	308.4365	287.6799	274.6844	281.2484	292.6510	314.2629	338.8823	357.3679			(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.7900	10.6334	0.6300	0.7000	0.7700		5.8170 (74)	
East					3.5800	19.6403	0.6300	0.7000	0.7700		21.4883 (76)	
West					3.2400	19.6403	0.6300	0.7000	0.7700		19.4475 (80)	
Solar gains	46.7528	91.1957	150.7686	222.6793	276.5900	285.0540	270.5774	229.7416	176.0922	108.2534	58.2181	38.5129 (83)
Total gains	414.6440	456.2599	502.2053	552.7082	585.0265	572.7339	545.2618	510.9900	468.7432	422.5163	397.1004	395.8808 (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	60.4314	60.6014	60.7690	61.5685	61.7205	62.4378	62.4378	62.5724	62.1595	61.7205	61.4139	61.0966				
alpha	5.0288	5.0401	5.0513	5.1046	5.1147	5.1625	5.1625	5.1715	5.1440	5.1147	5.0943	5.0731				
util living area	0.9985	0.9972	0.9932	0.9777	0.9264	0.7959	0.6294	0.6860	0.9043	0.9862	0.9971	0.9988				(86)
MIT	19.7284	19.8499	20.0822	20.4088	20.7109	20.9155	20.9803	20.9699	20.8185	20.4328	20.0282	19.7105				(87)
Th 2	19.9609	19.9635	19.9661	19.9781	19.9804	19.9909	19.9909	19.9928	19.9868	19.9804	19.9758	19.9710				(88)
util rest of house	0.9980	0.9962	0.9906	0.9684	0.8935	0.7104	0.4990	0.5575	0.8484	0.9788	0.9959	0.9984				(89)
MIT 2	18.2623	18.4417	18.7821	19.2617	19.6792	19.9298	19.9831	19.9793	19.8281	19.3022	18.7114	18.2434				(90)
Living area fraction	18.5265	18.6955	19.0164	19.4684	19.8652	20.1075	20.1628	20.1578	20.0066	19.5060	18.9487	18.5078				(92)
Temperature adjustment	18.5265	18.6955	19.0164	19.4684	19.8652	20.1075	20.1628	20.1578	20.0066	19.5060	18.9487	18.5078				(93)
adjusted MIT	18.5265	18.6955	19.0164	19.4684	19.8652	20.1075	20.1628	20.1578	20.0066	19.5060	18.9487	18.5078				(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Useful gains	413.3324	453.7198	495.7545	531.7617	520.0662	413.2164	284.8773	296.4891	398.3220	411.4978	394.7349	394.8905				(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	1197.3519	1157.8162	1047.5706	873.0445	672.8554	448.6321	290.2211	305.4479	483.3002	733.9043	981.2751	1191.0824				(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	583.3105	473.1528	410.5512	245.7236	113.6751	0.0000	0.0000	0.0000	0.0000	239.8705	422.3090	592.3668				(98)
Space heating												3080.9594				(98)
Space heating per m ²												42.0666				(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

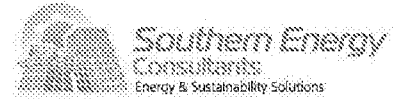
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3298.6718 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	583.3105	473.1528	410.5512	245.7236	113.6751	0.0000	0.0000	0.0000	0.0000	239.8705	422.3090	592.3668	(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)	624.5295	506.5876	439.5623	263.0873	121.7079	0.0000	0.0000	0.0000	0.0000	256.8207	452.1509	634.2257	(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	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419	(64)
Efficiency of water heater (217)m	87.6296	87.4782	87.0873	86.1610	84.3180	80.3000	80.3000	80.3000	80.3000	85.9842	87.1660	87.7077	(217)
Fuel for water heating, kWh/month	223.4871	195.5597	204.3804	183.2241	181.2706	167.6417	160.6135	179.0464	181.0238	192.5047	202.7090	218.0446	(219)
Water heating fuel used												2289.5055	(219)
Annual totals kWh/year													
Space heating fuel - main system												3298.6718	(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)												359.4216	(232)
Total delivered energy for all uses												6022.5989	(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	3298.6718	0.2160	712.5131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2289.5055	0.2160	494.5332 (264)
Space and water heating			1207.0463 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total CO2, kg/m2/year			1432.5111 (272)
Emissions per m2 for space and water heating			16.4807 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5470 (272b)
Emissions per m2 for pumps and fans			0.5315 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4807 * 1.00) + 2.5470 + 0.5315, rounded to 2 d.p.			19.5600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			9.0000	329.5800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15518.3600			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.8837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

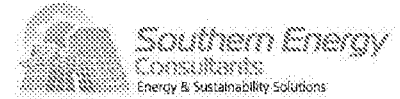
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1405.8389 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.9730	27.0892	27.9536	24.3707	23.3842	20.1788	18.6986	21.4570	21.7132	25.3047	27.6220	29.9957 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	41.6304	40.3113	37.5721	33.8481	31.4304	28.0261	25.1326	28.8400	30.1572	34.0116	38.3639	40.3168	(72)
Total internal gains	324.5524	323.0824	311.6137	292.9208	273.3057	255.0836	243.7221	247.5805	257.6272	276.4505	298.0001	314.7709	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.7900	10.6334	0.4400		0.0000		0.7700		6.4486 (74)
East				3.5800	19.6403	0.4400		0.0000		0.7700		23.8218 (76)
West				3.2400	19.6403	0.4400		0.0000		0.7700		21.5594 (80)
Solar gains	51.8297	101.0988	167.1409	246.8604	306.6253	316.0085	299.9598	254.6896	195.2143	120.0088	64.5401	42.6951 (83)
Total gains	376.3822	424.1811	478.7545	539.7812	579.9310	571.0921	543.6819	502.2701	452.8415	396.4593	362.5403	357.4660 (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	47.5061	47.6300	47.7521	48.3341	48.4446	48.9655	48.9655	49.0632	48.7635	48.4446	48.2216	47.9907	
alpha	4.1671	4.1753	4.1835	4.2223	4.2296	4.2644	4.2644	4.2709	4.2509	4.2296	4.2148	4.1994	
util living area	0.9977	0.9959	0.9905	0.9724	0.9212	0.8045	0.6545	0.7136	0.9082	0.9840	0.9961	0.9982	(86)
MIT	19.3682	19.5177	19.8034	20.2031	20.5781	20.8500	20.9545	20.9340	20.7137	20.2299	19.7333	19.3462	(87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989	(88)
util rest of house	0.9970	0.9946	0.9874	0.9623	0.8892	0.7222	0.5190	0.5834	0.8571	0.9764	0.9946	0.9977	(89)
MIT 2	18.4011	18.5522	18.8384	19.2414	19.5992	19.8380	19.9041	19.8969	19.7330	19.2734	18.7770	18.3868	(90)
Living area fraction	18.5754	18.7262	19.0123	19.4147	19.7756	20.0204	20.0934	20.0838	19.9098	19.4458	18.9494	18.5597	(91)
MIT	18.5754	18.7262	19.0123	19.4147	19.7756	20.0204	20.0934	20.0838	19.9098	19.4458	18.9494	18.5597	(92)
Temperature adjustment	18.5754	18.7262	19.0123	19.4147	19.7756	20.0204	20.0934	20.0838	19.9098	19.4458	18.9494	18.5597	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	374.8313	421.1069	471.0588	516.2219	512.8893	417.5469	295.1585	304.1092	387.9862	385.3315	359.9313	356.2843	(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	1295.3352	1251.3151	1129.5064	937.7503	718.5769	477.1809	307.5387	323.6544	513.5784	787.1087	1059.2459	1289.8299	(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	684.8549	557.8999	489.8850	303.5005	153.0316	0.0000	0.0000	0.0000	0.0000	298.9222	503.5065	694.5579	(98)
Space heating													3686.1586 (98)
Space heating per m2													(98) / (4) = 50.3299 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	827.5247	651.4556	667.7302	0.0000	0.0000	0.0000	0.0000 (100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

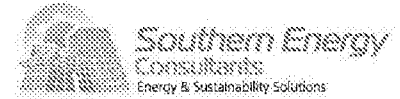


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7710	0.8487	0.8142	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	638.0274	552.9110	543.6925	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	754.7356	721.0150	674.3270	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	84.0299	125.0694	97.1921	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												306.2913 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	21.0075	31.2673	24.2980	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												76.5728 (107)
Space cooling per m2												1.0455 (108)
Energy for space heating												50.3299 (99)
Energy for space cooling												1.0455 (108)
Total												51.3754 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

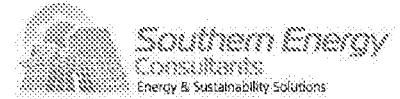
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)					
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148		(27)					
Heat Loss Floor 1			36.6200	0.1300	4.7606		(28a)					
Brick Cavity	85.6700	12.9100	72.7600	0.1800	13.0968		(29a)					
External Roof 1	36.6200		36.6200	0.1300	4.7606		(30)					
Total net area of external elements Aum(A, m2)			158.9100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7628		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0489 (36)					
Total fabric heat loss						(33) + (36) =	47.8117 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.3517	Feb 36.1156	Mar 35.8842	Apr 34.7973	May 34.5939	Jun 33.6472	Jul 33.6472	Aug 33.4719	Sep 34.0119	Oct 34.5939	Nov 35.0053	Dec 35.4354 (38)
Heat transfer coeff	84.1634	83.9273	83.6959	82.6089	82.4056	81.4589	81.4589	81.2836	81.8236	82.4056	82.8170	83.2471 (39)
Average = Sum(39)m / 12 =												82.6080 (39)
HLP	Jan 1.1491	Feb 1.1459	Mar 1.1428	Apr 1.1279	May 1.1251	Jun 1.1122	Jul 1.1122	Aug 1.1098	Sep 1.1172	Oct 1.1251	Nov 1.1308	Dec 1.1366 (40)
HLP (average)												1.1279 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
Daily hot water use	Jan 98.2861	Feb 94.7120	Mar 91.1380	Apr 87.5640	May 83.9899	Jun 80.4159	Jul 80.4159	Aug 83.9899	Sep 87.5640	Oct 91.1380	Nov 94.7120	Dec 98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)
Energy content (annual)										Total = Sum(45)m =		1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.9730	27.0892	27.9536	24.3707	23.3842	20.1788	18.6986	21.4570	21.7132	25.3047	27.6220	29.9957 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	41.6304	40.3113	37.5721	33.8461	31.4304	28.0261	25.1326	28.8400	30.1572	34.0116	38.3639	40.3168	(72)
Total internal gains	324.5524	323.0824	311.6137	292.9208	273.3057	255.0836	243.7221	247.5805	257.6272	276.4505	298.0001	314.7709	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.7900	10.6334	0.6300	0.7000	0.7700	5.8170 (74)
East	3.5800	19.6403	0.6300	0.7000	0.7700	21.4883 (76)
West	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475 (80)

Solar gains	46.7528	91.1957	150.7686	222.6793	276.5900	285.0540	270.5774	229.7416	176.0922	108.2534	58.2181	38.5129	(83)
Total gains	371.3052	414.2780	462.3823	515.6001	549.8957	540.1376	514.2995	477.3221	433.7194	384.7039	356.2183	353.2839	(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	60.4314	60.6014	60.7690	61.5685	61.7205	62.4378	62.4378	62.5724	62.1595	61.7205	61.4139	61.0966	
alpha	5.0288	5.0401	5.0513	5.1046	5.1147	5.1625	5.1625	5.1715	5.1440	5.1147	5.0943	5.0731	
util living area	0.9991	0.9982	0.9953	0.9832	0.9405	0.8225	0.6602	0.7217	0.9256	0.9908	0.9982	0.9993	(86)
MIT	19.6732	19.7967	20.0326	20.3658	20.6790	20.9005	20.9756	20.9620	20.7895	20.3870	19.9763	19.6561	(87)
Th 2	19.9609	19.9635	19.9661	19.9781	19.9804	19.9909	19.9909	19.9928	19.9868	19.9804	19.9758	19.9710	(88)
util rest of house	0.9988	0.9976	0.9934	0.9759	0.9122	0.7406	0.5268	0.5922	0.8778	0.9856	0.9975	0.9991	(89)
MIT 2	18.7461	18.8715	19.1087	19.4477	19.7475	19.9403	19.9841	19.9807	19.8566	19.4731	19.0609	18.7371	(90)
Living area fraction									fLA = Living area / (4) =			0.1802	(91)
MIT	18.9132	19.0382	19.2752	19.6132	19.9154	20.1134	20.1628	20.1575	20.0247	19.6378	19.2258	18.9027	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9132	19.0382	19.2752	19.6132	19.9154	20.1134	20.1628	20.1575	20.0247	19.6378	19.2258	18.9027	(93)

8. Space heating requirement

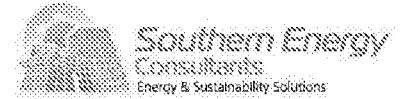
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9983	0.9968	0.9917	0.9725	0.9099	0.7519	0.5511	0.6154	0.8800	0.9832	0.9967	0.9987	(94)
Useful gains	370.6767	412.9347	458.5566	501.4250	500.3645	406.1438	283.4258	293.7559	381.6919	378.2498	355.0454	352.8238	(95)
Ext temp.	4.3000	4.9000	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	1229.8933	1186.5842	1069.2346	885.0033	676.9939	449.1152	290.2186	305.4271	484.7813	744.7641	1004.2253	1223.9580	(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	639.2572	519.8925	454.3445	276.1764	131.4123	0.0000	0.0000	0.0000	0.0000	272.6866	467.4095	648.1238	(98)
Space heating												3409.3027	(98)
Space heating per m ²										(98) / (4) =		46.5497	(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	765.7137	602.7959	617.7553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8100	0.8870	0.8556	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	620.2122	534.7076	528.5469	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	718.5551	686.6719	645.1670	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	70.8068	113.0615	86.7654	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

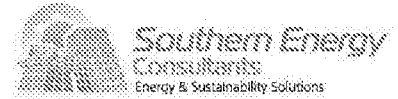


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												270.6337 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	17.7017	28.2654	21.6913	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												67.6584 (107)
Space cooling per m2												0.9238 (108)
Energy for space heating												46.5497 (99)
Energy for space cooling												0.9238 (108)
Total												47.4735 (109)
Target Fabric Energy Efficiency (TFEE)												54.6 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) = 0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2657		(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15847.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss							(33) + (36) = 54.3873 (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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	88.7825	88.3992	88.3992	87.8592	87.8592	87.2047	87.3614	87.0528	87.2047	87.5226	87.5226	88.0345 (39)
Average = Sum(39)m / 12 =												87.7669 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2122	1.2070	1.2070	1.1996	1.1996	1.1907	1.1928	1.1886	1.1907	1.1950	1.1950	1.2020 (40)
HLP (average)												1.1983 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

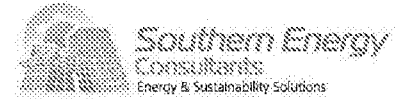
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1405.8389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083 (61)
Total heat required for water heating calculated for each month											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				1.7900	11.9814	0.4400	0.0000	0.7700		7.2662 (74)		
East				3.5800	22.3313	0.4400	0.0000	0.7700		27.0857 (76)		
West				3.2400	22.3313	0.4400	0.0000	0.7700		24.5134 (80)		

Solar gains	58.8653	103.4024	168.8147	256.5062	309.8665	341.4847	320.7486	278.8996	213.5982	131.0636	75.1182	48.0050 (83)
Total gains	585.8994	625.8469	670.5321	726.4441	747.5135	750.3724	713.0333	679.5145	632.7103	582.1592	561.5377	560.9112 (84)

7. Mean internal temperature (heating season)

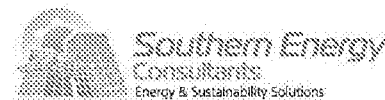
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.5841	49.7992	49.7992	50.1052	50.1052	50.4813	50.3908	50.5694	50.4813	50.2979	50.2979	50.0054
alpha	4.3056	4.3199	4.3199	4.3403	4.3403	4.3654	4.3594	4.3713	4.3654	4.3532	4.3532	4.3337
util living area	0.9866	0.9809	0.9628	0.9104	0.7869	0.5570	0.3763	0.4050	0.7131	0.9230	0.9760	0.9885 (86)
MIT	19.8189	19.9398	20.2105	20.5541	20.8371	20.9743	20.9965	20.9952	20.9223	20.5943	20.1616	19.7999 (87)
Th 2	19.9102	19.9144	19.9144	19.9203	19.9203	19.9275	19.9258	19.9291	19.9275	19.9240	19.9240	19.9184 (88)
util rest of house	0.9827	0.9753	0.9513	0.8817	0.7207	0.4482	0.2478	0.2721	0.6127	0.8917	0.9677	0.9851 (89)
MIT 2	18.3764	18.5537	18.9414	19.4212	19.7762	19.9146	19.9251	19.9282	19.8762	19.4879	18.8824	18.3547 (90)
Living area fraction	fLA = Living area / (4) =											0.1802 (91)
MIT	18.6364	18.8035	19.1701	19.6254	19.9674	20.1056	20.1182	20.1205	20.0647	19.6873	19.1129	18.6152 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4864	18.6535	19.0201	19.4754	19.8174	19.9556	19.9682	19.9705	19.9147	19.5373	18.9629	18.4652 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9753	0.9661	0.9387	0.8671	0.7135	0.4512	0.2529	0.2773	0.6113	0.8773	0.9573	0.9785	(94)
Useful gains	571.4246	604.6519	629.3970	629.9215	533.3735	338.5848	180.3416	188.4392	386.8063	510.7331	537.5639	548.8397	(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	1188.4765	1153.9209	1027.2114	841.2880	598.9703	344.9487	180.6814	188.9468	411.1458	694.6953	959.5026	1176.5979	(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	459.0866	369.1088	295.9739	152.1839	48.8041	0.0000	0.0000	0.0000	0.0000	136.8679	303.7958	467.0521	(98)
Space heating												2232.8730	(98)
RHI space heating demand												2233	(98)

FULL SAP CALCULATION PRINTOUT

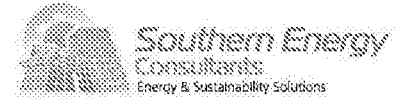
Calculation Type: New Build (As Designed)



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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15847.9400 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

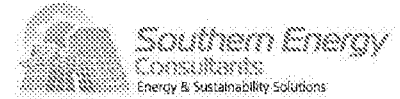
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
								Total per year (kWh/year) = Sum(64)m =					1570.8557 (64)
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.7900	10.6334	0.4400	0.0000	0.7700	6.4486 (74)			
East				3.5800	19.6403	0.4400	0.0000	0.7700	23.8218 (76)			
West				3.2400	19.6403	0.4400	0.0000	0.7700	21.5594 (80)			
Solar gains	51.8297	101.0988	167.1409	246.8604	306.6253	316.0085	299.9598	254.6896	195.2143	120.0088	64.5401	42.6951 (83)
Total gains	578.8639	623.5433	668.8583	716.7983	744.2723	724.8962	692.2445	655.3045	614.3265	571.1045	550.9596	555.6014 (84)

7. Mean internal temperature (heating season)

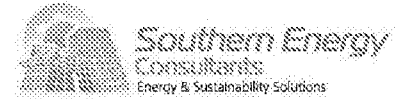
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.5150	48.6416	48.7663	49.3606	49.4734	50.0054	50.0054	50.1052	49.7992	49.4734	49.2457	49.0099
alpha	4.2343	4.2428	4.2511	4.2907	4.2982	4.3337	4.3337	4.3403	4.3199	4.2982	4.2830	4.2673
util living area	0.9894	0.9842	0.9710	0.9344	0.8516	0.6987	0.5387	0.5854	0.8091	0.9479	0.9827	0.9911 (86)
MIT	19.6716	19.8106	20.0694	20.4207	20.7257	20.9191	20.9795	20.9708	20.8399	20.4561	20.0082	19.6460 (87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989 (88)
util rest of house	0.9864	0.9797	0.9623	0.9136	0.8035	0.6078	0.4161	0.4622	0.7334	0.9270	0.9769	0.9885 (89)
MIT 2	18.1479	18.3509	18.7253	19.2287	19.6336	19.8610	19.9100	19.9070	19.7827	19.2883	18.6474	18.1175 (90)
Living area fraction	18.4225	18.6140	18.9676	19.4435	19.8305	20.0517	20.1027	20.0987	19.9732	19.4988	18.8927	18.3930 (91)
MIT	18.4225	18.6140	18.9676	19.4435	19.8305	20.0517	20.1027	20.0987	19.9732	19.4988	18.8927	18.3930 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2725	18.4640	18.8176	19.2935	19.6805	19.9017	19.9527	19.9487	19.8232	19.3488	18.7427	18.2430 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9800	0.9714	0.9507	0.8988	0.7917	0.6062	0.4202	0.4657	0.7260	0.9127	0.9680	0.9829	(94)
Ext temp.	567.2976	605.7046	635.8565	644.2614	589.2570	439.4626	290.9005	305.1587	446.0012	521.2723	533.3394	546.0758	(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	1267.8506	1227.5833	1111.9255	926.9419	710.1109	466.7305	295.1559	311.7893	505.9283	778.4750	1040.7716	1261.3776	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	521.2114	417.9025	354.1953	203.5299	89.9153	0.0000	0.0000	0.0000	0.0000	191.3588	365.3512	532.1845	(98)
Space heating per m2												2675.6489	(98)
												36.5326	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2956.5182 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	521.2114	417.9025	354.1953	203.5299	89.9153	0.0000	0.0000	0.0000	0.0000	191.3588	365.3512	532.1845	(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)	575.9242	461.7708	391.3760	224.8950	99.3539	0.0000	0.0000	0.0000	0.0000	211.4462	403.7030	588.0492	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)
Efficiency of water heater (217)m	89.7280	89.6743	89.5439	89.2357	88.6169	87.3000	87.3000	87.3000	87.3000	89.1593	89.5736	89.7570	(217)
Fuel for water heating, kWh/month	178.1559	156.3365	162.5916	143.7085	139.9527	124.2327	116.7468	131.6541	132.5400	149.2808	160.3086	172.9624	(219)
Water heating fuel used												1768.4706	(219)
Annual totals kWh/year													
Space heating fuel - main system													2956.5182 (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)													359.4216 (232)
Total delivered energy for all uses													5159.4103 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2956.5182	3.4800	102.8868 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1768.4706	3.4800	61.5428 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	359.4216	13.1900	47.4077 (250)
Additional standing charges			120.0000 (251)
Total energy cost			341.7298 (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] =	1.2139 (257)
SAP value		83.0667
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	2956.5182	0.2160	638.6079 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1768.4706	0.2160	381.9897 (264)
Space and water heating			1020.5976 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total kg/year			1246.0624 (272)
CO2 emissions per m2			17.0100 (273)
EI value			85.8785
EI rating			B6 (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	$3.48 / 0.8871 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8871 = 0.2435$, stars = 4

Regs Region: England

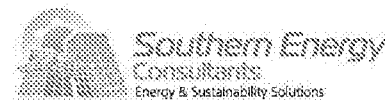
Elmhurst Energy Systems

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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15847.9400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	88.7825	88.3992	88.3992	87.8592	87.8592	87.2047	87.3614	87.0528	87.2047	87.5226	87.5226	88.0345 (39)
Average = Sum(39)m / 12 =												87.7669 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2122	1.2070	1.2070	1.1996	1.1996	1.1907	1.1928	1.1886	1.1907	1.1950	1.1950	1.2020 (40)
HLP (average)												1.1983 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

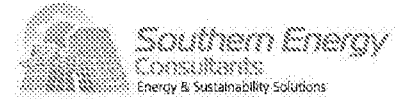
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
								Total per year (kWh/year) = Sum(64)m =					1570.8557 (64)
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	1.7900				11.9814		0.4400		0.0000		0.7700		7.2662 (74)	
East	3.5800				22.3313		0.4400		0.0000		0.7700		27.0857 (76)	
West	3.2400				22.3313		0.4400		0.0000		0.7700		24.5134 (80)	
Solar gains	58.8653	103.4024	168.8147	256.5062	309.8665	341.4847	320.7486	278.8996	213.5982	131.0636	75.1182	48.0050	(83)	
Total gains	585.8994	625.8469	670.5321	726.4441	747.5135	750.3724	713.0333	679.5145	632.7103	582.1592	561.5377	560.9112	(84)	

7. Mean internal temperature (heating season)

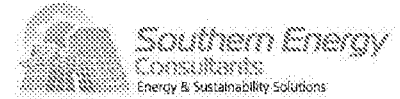
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.5841	49.7992	49.7992	50.1052	50.1052	50.4813	50.3908	50.5694	50.4813	50.2979	50.2979	50.0054
alpha	4.3056	4.3199	4.3199	4.3403	4.3403	4.3654	4.3594	4.3713	4.3654	4.3532	4.3532	4.3337
util living area	0.9866	0.9809	0.9628	0.9104	0.7869	0.5570	0.3763	0.4050	0.7131	0.9230	0.9760	0.9885 (86)
MIT	19.8189	19.9398	20.2105	20.5541	20.8371	20.9743	20.9965	20.9952	20.9223	20.5943	20.1616	19.7999 (87)
Th 2	19.9102	19.9144	19.9144	19.9203	19.9203	19.9275	19.9258	19.9291	19.9275	19.9240	19.9240	19.9184 (88)
util rest of house	0.9827	0.9753	0.9513	0.8817	0.7207	0.4482	0.2478	0.2721	0.6127	0.8917	0.9677	0.9851 (89)
MIT 2	18.3764	18.5537	18.9414	19.4212	19.7762	19.9146	19.9251	19.9282	19.8762	19.4879	18.8824	18.3547 (90)
Living area fraction	18.6364	18.8035	19.1701	19.6254	19.9674	20.1056	20.1182	20.1205	20.0647	19.6873	19.1129	18.6152 (91)
MIT	18.6364	18.8035	19.1701	19.6254	19.9674	20.1056	20.1182	20.1205	20.0647	19.6873	19.1129	18.6152 (92)
Temperature adjustment	18.4864	18.6535	19.0201	19.4754	19.8174	19.9556	19.9682	19.9705	19.9147	19.5373	18.9629	-0.1500
adjusted MIT	18.4864	18.6535	19.0201	19.4754	19.8174	19.9556	19.9682	19.9705	19.9147	19.5373	18.9629	18.4652 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	571.4246	604.6519	629.3970	629.9215	533.3735	338.5848	180.3416	188.4392	386.8063	510.7331	537.5639	548.8397	(94)
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	1188.4765	1153.9209	1027.2114	841.2880	598.9703	344.9487	180.6814	188.9468	411.1458	694.6953	959.5026	1176.5979	(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	459.0866	369.1088	295.9739	152.1839	48.8041	0.0000	0.0000	0.0000	0.0000	136.8679	303.7958	467.0521	(98)
Space heating												2232.8730	(98)
Space heating per m2												(98) / (4) = 30.4871	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2467.2630	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	459.0866	369.1088	295.9739	152.1839	48.8041	0.0000	0.0000	0.0000	0.0000	136.8679	303.7958	467.0521	(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)	507.2780	407.8550	327.0430	168.1590	53.9271	0.0000	0.0000	0.0000	0.0000	151.2352	335.6860	516.0796	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)	
Efficiency of water heater (217)m	89.6513	89.5960	89.4193	89.0080	88.1805	87.3000	87.3000	87.3000	87.3000	88.8935	89.4477	89.6799	(217)	
Fuel for water heating, kWh/month	178.3085	156.4732	162.8181	144.0761	140.6454	124.2327	116.7468	131.6541	132.5400	149.7272	160.5344	173.1111	(219)	
Water heating fuel used												1770.8674	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2467.2630	(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)													359.4216	(232)
Total delivered energy for all uses													4672.5519	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2467.2630	3.8700	95.4831 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1770.8674	3.8700	68.5326 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	359.4216	18.9000	67.9307 (250)
Additional standing charges			93.0000 (251)
Total energy cost			339.1213 (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	2467.2630	0.2160	532.9288 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1770.8674	0.2160	382.5074 (264)
Space and water heating			915.4362 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total kg/year			1140.9010 (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	2467.2630	1.2200	3010.0608 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1770.8674	1.2200	2160.4582 (264)
Space and water heating			5170.5191 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	359.4216	3.0700	1103.4242 (268)
Primary energy kWh/year			6504.1933 (272)
Primary energy kWh/m2/year			88.8066 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 27	-177 kg (15.5%)
U Solar photovoltaic panels	+ 11.3	-£ 345	-947 kg (98.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£27	2.42 kg/m²	B 84 B 88
Solar photovoltaic panels	£345	12.93 kg/m²	A 96 A 98
Total Savings	£372	15.35 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 98

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)

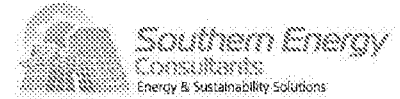
Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£82	£92	-£9
Mains gas	£257	£221	£36
Space heating	£203	£203	£0
Water heating	£69	£42	£27
Lighting	£68	£68	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£339	-£32	£372
Total cost of uses	£340	-£32	£372
Delivered energy	64 kWh/m²	27 kWh/m²	37 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	16 kg/m²	0 kg/m²	15 kg/m²
Primary energy	89 kWh/m²	-1 kWh/m²	90 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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) = 0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15847.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss							(33) + (36) = 54.3873 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

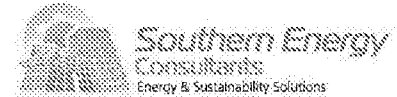
Elmhurst Energy Systems

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 content (annual)	Total = Sum(45)m =											1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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												1.2900 (H8)
Utilisation factor												0.5394 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												89.3510 (H14)
Volume ratio Veff/V												0.8394 (H15)
Solar storage volume factor												0.9650 (H16)
Solar input												-830.0107 (H17)
Solar input	-24.0687	-40.1637	-68.4033	-91.6739	-113.2554	-111.3481	-109.8766	-95.9997	-75.1871	-51.3439	-28.5489	-20.1414 (63)
	Solar input (sum of months) = Sum(63)m =											-830.0107 (63)
Output from w/h	135.7871	100.0300	77.1875	36.5653	10.7664	0.0000	0.0000	18.9342	40.5203	81.7539	115.0453	135.1045 (64)
	Total per year (kWh/year) = Sum(64)m =											751.6946 (64)
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.7900	10.6334	0.4400	0.0000	0.7700	6.4486 (74)
East	3.5800	19.6403	0.4400	0.0000	0.7700	23.8218 (76)
West	3.2400	19.6403	0.4400	0.0000	0.7700	21.5594 (80)

Solar gains	51.8297	101.0988	167.1409	246.8604	306.6253	316.0085	299.9598	254.6896	195.2143	120.0088	64.5401	42.6951 (83)
Total gains	578.8639	623.5433	668.8583	716.7983	744.2723	724.8962	692.2445	655.3045	614.3265	571.1045	550.9596	555.6014 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	48.5150	48.6416	48.7663	49.3606	49.4734	50.0054	50.0054	50.1052	49.7992	49.4734	49.2457	49.0099
util living area	4.2343	4.2428	4.2511	4.2907	4.2982	4.3337	4.3337	4.3403	4.3199	4.2982	4.2830	4.2673
	0.9894	0.9842	0.9710	0.9344	0.8516	0.6987	0.5387	0.5854	0.8091	0.9479	0.9827	0.9911 (86)
MIT	19.6716	19.8106	20.0694	20.4207	20.7257	20.9191	20.9795	20.9708	20.8399	20.4561	20.0082	19.6460 (87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989 (88)
util rest of house	0.9864	0.9797	0.9623	0.9136	0.8035	0.6078	0.4161	0.4622	0.7334	0.9270	0.9769	0.9885 (89)
MIT 2	18.1479	18.3509	18.7253	19.2287	19.6336	19.8610	19.9100	19.9070	19.7827	19.2883	18.6474	18.1175 (90)
Living area fraction	fLA = Living area / (4) =											0.1802 (91)
MIT	18.4225	18.6140	18.9676	19.4435	19.8305	20.0517	20.1027	20.0987	19.9732	19.4988	18.8927	18.3930 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2725	18.4640	18.8176	19.2935	19.6805	19.9017	19.9527	19.9487	19.8232	19.3488	18.7427	18.2430 (93)

**Southern Energy
Consultants**
Energy & Sustainability Solutions

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9800	0.9714	0.9507	0.8988	0.7917	0.6062	0.4202	0.4657	0.7260	0.9127	0.9680	0.9829 (94)
Useful gains	567.2976	605.7046	635.8565	644.2614	589.2570	439.4626	290.9005	305.1587	446.0012	521.2723	533.3394	546.0758 (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	1267.8506	1227.5833	1111.9255	926.9419	710.1109	466.7305	295.1559	311.7893	505.9283	778.4750	1040.7716	1261.3776 (97)
Month fractl	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	521.2114	417.9025	354.1953	203.5299	89.9153	0.0000	0.0000	0.0000	0.0000	191.3588	365.3512	532.1845 (98)
Space heating												2675.6489 (98)
Space heating per m2												36.5326 (99)
										(98) / (4) =		

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	2956.5182	(211)

[illegible]

Water heating requirement													
135.7871	100.0300	77.1875	36.5653	10.7664	0.0000	0.0000	18.9342	40.5203	81.7539	115.0453	135.1045	(64)	
Efficiency of water heater													
(217)m	89.8195	89.8638	89.9103	89.9976	90.1467	87.3000	87.3000	87.3000	87.3000	89.5176	89.7125	87.3000	(216)
Fuel for water heating, kWh/month													
151.1777	111.3129	85.8494	40.6292	11.9432	0.0000	0.0000	21.6887	46.4150	91.3270	128.2378	150.3947	89.8333	(217)
Water heating fuel used												838.9757	(219)
Annual totals kWh/year													
Space heating fuel - main system												2956.5182	(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)		359.4216 (232)
Energy saving/generation technologies (Appendices M, N and Q)		
PV Unit 0 (0.80 * 2.50 * 1050 * 0.80) =	-1727.2394	-1727.2394 (233)
Total delivered energy for all uses		2552.6760 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2956.5182	3.4800	102.8868 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	838.9757	3.4800	29.1964 (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	359.4216	13.1900	47.4077 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			88.1555 (252)

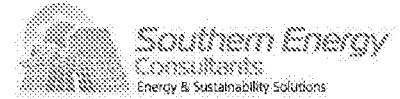
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3131 (257)
SAP value		95.6317
SAP rating (Section 12)		96 (258)
SAP band		A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2956.5182	0.2160	638.6079 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	838.9757	0.2160	181.2187 (264)
Space and water heating			819.8267 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			174.8042 (272)
CO2 emissions per m2			2.3900 (273)
EI value			98.0190
EI rating			98 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) = 0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (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 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2657		(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 15847.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss							(33) + (36) = 54.3873 (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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	88.7825	88.3992	88.3992	87.8592	87.8592	87.2047	87.3614	87.0528	87.2047	87.5226	87.5226	88.0345 (39)
Average = Sum(39)m / 12 =												87.7669 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2122	1.2070	1.2070	1.1996	1.1996	1.1907	1.1928	1.1886	1.1907	1.1950	1.1950	1.2020 (40)
HLP (average)												1.1983 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

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 content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month													
	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)	
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-26.0120	-39.0960	-65.8427	-91.0148	-109.6124	-115.3623	-112.5922	-100.5455	-78.4761	-53.3858	-31.6183	-845.1092 (H17)	
Output from w/h													
	133.8438	101.0976	79.7481	37.2245	14.4094	0.0000	0.0000	14.3885	37.2313	79.7119	111.9759	133.6947 (64)	
Heat gains from water heating, kWh/month													
	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.7900	11.9814	0.4400	0.0000	0.7700	7.2662 (74)
East	3.5800	22.3313	0.4400	0.0000	0.7700	27.0857 (76)
West	3.2400	22.3313	0.4400	0.0000	0.7700	24.5134 (80)

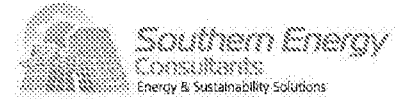
Solar gains	58.8653	103.4024	168.8147	256.5062	309.8665	341.4847	320.7486	278.8996	213.5982	131.0636	75.1182	48.0050 (83)
Total gains	585.8994	625.8469	670.5321	726.4441	747.5135	750.3724	713.0333	679.5145	632.7103	582.1592	561.5377	560.9112 (84)

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	49.5841	49.7992	49.7992	50.1052	50.1052	50.4813	50.3908	50.5694	50.4813	50.2979	50.2979	50.0054
alpha	4.3056	4.3199	4.3199	4.3403	4.3403	4.3654	4.3594	4.3713	4.3654	4.3532	4.3532	4.3337
util living area	0.9866	0.9809	0.9628	0.9104	0.7869	0.5570	0.3763	0.4050	0.7131	0.9230	0.9760	0.9885 (86)
MIT	19.8189	19.9398	20.2105	20.5541	20.8371	20.9743	20.9965	20.9952	20.9223	20.5943	20.1616	19.7999 (87)
Th 2	19.9102	19.9144	19.9144	19.9203	19.9203	19.9275	19.9258	19.9291	19.9275	19.9240	19.9240	19.9184 (88)
util rest of house	0.9827	0.9753	0.9513	0.8817	0.7207	0.4482	0.2478	0.2721	0.6127	0.8917	0.9677	0.9851 (89)
MIT 2	18.3764	18.5537	18.9414	19.4212	19.7762	19.9146	19.9251	19.9282	19.8762	19.4879	18.8824	18.3547 (90)
Living area fraction												
MIT	18.6364	18.8035	19.1701	19.6254	19.9674	20.1056	20.1182	20.1205	20.0647	19.6873	19.1129	18.6152 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4864	18.6535	19.0201	19.4754	19.8174	19.9556	19.9682	19.9705	19.9147	19.5373	18.9629	18.4652 (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	0.9753	0.9661	0.9387	0.8671	0.7135	0.4512	0.2529	0.2773	0.6113	0.8773	0.9573	0.9785	(94)
Useful gains	571.4246	604.6519	629.3970	629.9215	533.3735	338.5848	180.3416	188.4392	386.8063	510.7331	537.5639	548.8397	(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	1188.4765	1153.9209	1027.2114	841.2880	598.9703	344.9487	180.6814	188.9468	411.1458	694.6953	959.5026	1176.5979	(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	459.0866	369.1088	295.9739	152.1839	48.8041	0.0000	0.0000	0.0000	0.0000	136.8679	303.7958	467.0521	(98)
Space heating												2232.8730	(98)
Space heating per m2												(98) / (4) =	30.4871 (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													2467.2630 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.0866	369.1088	295.9739	152.1839	48.8041	0.0000	0.0000	0.0000	0.0000	136.8679	303.7958	467.0521	(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)	507.2780	407.8550	327.0430	168.1590	53.9271	0.0000	0.0000	0.0000	0.0000	151.2352	335.6860	516.0796	(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	133.8438	101.0976	79.7481	37.2245	14.4094	0.0000	0.0000	14.3885	37.2313	79.7119	111.9759	133.6947	(64)
Efficiency of water heater	89.7573	89.7923	89.8013	89.8527	89.7501	87.3000	87.3000	87.3000	87.3000	89.2953	89.6153	89.7677	(217)
Fuel for water heating, kWh/month	149.1174	112.5905	88.8051	41.4284	16.0551	0.0000	0.0000	16.4817	42.6475	89.2678	124.9518	148.9341	(219)
Water heating fuel used												830.2791	(219)
Annual totals kWh/year													
Space heating fuel - main system												2467.2630	(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)												359.4216	(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												1957.8040	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2467.2630	3.8700	95.4831	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	830.2791	3.8700	32.1318	(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	359.4216	18.9000	67.9307	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			-32.5956	(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	2467.2630	0.2160	532.9288	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	830.2791	0.2160	179.3403	(264)
Space and water heating			712.2691	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	359.4216	0.5190	186.5398	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

Regs Region: England

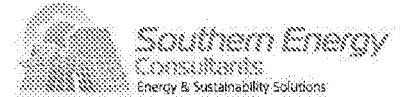
Elmhurst Energy Systems

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

Total kg/year 16.9450 (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	2467.2630	1.2200	3010.0608 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	830.2791	1.2200	1012.9405 (264)
Space and water heating			4023.0014 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	359.4216	3.0700	1103.4242 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-89.9945 (272)
Primary energy kWh/m2/year			-1.2288 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached 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	216.4 (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	242.18 (P1)
Transmission heat loss coefficient	54.39 (37)
Summer heat loss coefficient	296.56 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.7900	81.1852	0.4400	0.0000	0.9000	57.5473
East	3.5800	117.5071	0.4400	0.0000	0.9000	166.5874
West	3.2400	117.5071	0.4400	0.0000	0.9000	150.7663

total: 374.9010

	Jun	Jul	Aug	
Solar gains	399	375	326	(P4)
Internal gains	406	389	398	
Total summer gains	805	764	724	(P5)

Summer gain/loss ratio	2.71	2.58	2.44	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 216.4)	0.49	0.49	0.49	
Threshold temperature	19.20	20.96	20.73	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight