

FULL SAP CALCULATION PRINTOUT

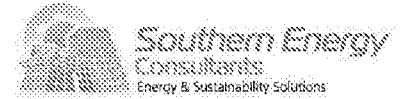
Calculation Type: New Build (As Designed)



Property Reference	SECANG001			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br F Ea Ga		
Property	Holywell, Plot 1				
SAP Rating	85 B	DER	16.00	TER	16.44
Environmental	36 B	% DER<TER	2.65		
CO ₂ Emissions (t/year)	1.69	DPEE	49.50	TPEE	54.12
General Requirements Compliance	Pass	% DPEE<TPEE	8.55		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 129 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) 16.44 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.00 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 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	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

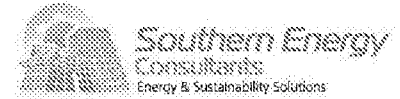
Overshading: Average
Windows facing North: 0.60 m², No overhang
Windows facing East: 8.11 m², No overhang
Windows facing West: 10.07 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.035 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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss							(33) + (36) = 92.6136 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.6446	152.3090	151.9800	150.4347	150.1456	148.7997	148.7997	148.5504	149.3181	150.1456	150.7305	151.3419 (39)
Average = Sum(39)m / 12 =												150.4333 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1837	1.1811	1.1785	1.1665	1.1643	1.1538	1.1538	1.1519	1.1579	1.1643	1.1688	1.1736 (40)
HLP (average)												1.1665 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

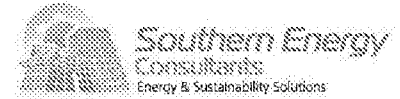
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	473.7289	471.2807	453.9207	425.7615	396.6791	369.1606	351.6389	358.4011	373.1975	401.5921	434.1631	459.0584	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			0.6000		10.6334		0.4400		0.0000		0.7700		2.1616 (74)
East			8.1100		19.6403		0.4400		0.0000		0.7700		53.9649 (76)
West			10.0700		19.6403		0.4400		0.0000		0.7700		67.0070 (80)
Solar gains	123.1335	240.7776	396.7428	579.6633	711.7696	729.3345	694.0568	595.1885	461.7040	285.7185	153.5043	101.2834	(83)
Total gains	596.8623	712.0583	850.6635	1005.4248	1108.4487	1098.4951	1045.6957	953.5896	834.9015	687.3107	587.6675	560.3418	(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	43.4834	43.5792	43.6736	44.1222	44.2072	44.6070	44.6070	44.6819	44.4521	44.2072	44.0356	43.8577
alpha	3.8989	3.9053	3.9116	3.9415	3.9471	3.9738	3.9738	3.9788	3.9635	3.9471	3.9357	3.9238
util living area	0.9973	0.9943	0.9850	0.9544	0.8783	0.7383	0.5858	0.6500	0.8728	0.9777	0.9952	0.9979 (86)
MIT	19.2247	19.4143	19.7576	20.2150	20.6141	20.8707	20.9614	20.9419	20.7244	20.1882	19.6231	19.1938 (87)
Th 2	19.9331	19.9352	19.9372	19.9469	19.9487	19.9571	19.9571	19.9587	19.9539	19.9487	19.9450	19.9412 (88)
util rest of house	0.9966	0.9928	0.9808	0.9405	0.8395	0.6558	0.4641	0.5294	0.8164	0.9686	0.9936	0.9974 (89)
MIT 2	17.5490	17.8272	18.3279	18.9900	19.5371	19.8543	19.9381	19.9268	19.6962	18.9623	18.1394	17.5090 (90)
Living area fraction	17.7538	18.0212	18.5026	19.1397	19.6687	19.9785	20.0631	20.0508	19.8219	19.1121	18.3207	17.7149 (91)
MIT	17.7538	18.0212	18.5026	19.1397	19.6687	19.9785	20.0631	20.0508	19.8219	19.1121	18.3207	17.7149 (92)
Temperature adjustment	17.6038	17.8712	18.3526	18.9897	19.5187	19.8285	19.9131	19.9008	19.6719	18.9621	18.1707	-0.1500
adjusted MIT	17.6038	17.8712	18.3526	18.9897	19.5187	19.8285	19.9131	19.9008	19.6719	18.9621	18.1707	17.5649 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9940	0.9880	0.9712	0.9234	0.8201	0.6443	0.4586	0.5220	0.7971	0.9558	0.9893	0.9953	(94)	
Useful gains	593.2942	703.5361	826.1909	928.4223	909.0353	707.7362	479.5432	497.7758	665.5222	656.9304	581.3684	557.7060	(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	2030.7556	1975.6236	1801.3607	1517.8465	1173.9481	778.0029	492.9912	520.0492	831.9806	1255.5366	1668.6945	2022.6724	(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	1069.4713	854.8428	725.5263	424.3854	197.0951	0.0000	0.0000	0.0000	0.0000	445.3630	782.8748	1089.9350	(98)	
Space heating												5589.4937	(98)	
Space heating per m2												(98) / (4) =	43.3428	(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													6176.2362	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1069.4713	854.8428	725.5263	424.3854	197.0951	0.0000	0.0000	0.0000	0.0000	445.3630	782.8748	1089.9350	(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)	1181.7363	944.5777	801.6865	468.9342	217.7846	0.0000	0.0000	0.0000	0.0000	492.1138	865.0550	1204.3481	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	90.0201	89.9812	89.8877	89.6601	89.1387	87.3000	87.3000	87.3000	87.3000	89.6669	89.9309	90.0396	(217)	
Fuel for water heating, kWh/month	202.1790	177.3412	184.2304	162.4960	157.9220	140.7841	132.0841	149.2571	150.3538	168.6367	181.6455	196.2394	(219)	
Water heating fuel used												2003.1692	(219)	
Annual totals kWh/year														
Space heating fuel - main system													6176.2362	(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)													496.5096	(232)
Total delivered energy for all uses													8750.9150	(238)

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

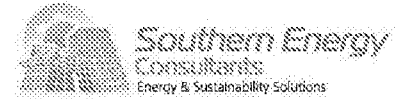
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6176.2362	0.2160	1334.0670 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.1692	0.2160	432.6845 (264)
Space and water heating			1766.7516 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total CO2, kg/year			2063.3650 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0000 (273)

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

DER		16.0000	ZC1
Total Floor Area	TFA	128.9600	
Assumed number of occupants	N	2.8922	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6226	ZC2
CO2 emissions from cooking, equation (L16)		1.4610	ZC3
Total CO2 emissions		31.0837	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		31.0837	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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER 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)			18.7800	1.3258	24.8977		(27)
Heat Loss Floor 1			64.4800	0.1300	8.3824		(28a)
Brick Cavity	131.1300	15.7100	115.4200	0.1800	20.7756		(29a)
Flint Cavity	26.1300	7.3700	18.7600	0.1800	3.3768		(29a)
Main Plane	64.4800		64.4800	0.1300	8.3824		(30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.5449		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3550 (36)
Total fabric heat loss						(33) + (36) =	82.8999 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	142.9310	142.5953	142.2663	140.7210	140.4319	139.0860	139.0860	138.8368	139.6044	140.4319	141.0168	141.6283 (39)
Average = Sum(39)m / 12 =												140.7196 (39)
HLP	1.1083	1.1057	1.1032	1.0912	1.0890	1.0785	1.0785	1.0766	1.0825	1.0890	1.0935	1.0982 (40)
HLP (average)												1.0912 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)
Energy content (annual)										Total = Sum(45)m =		1618.8725 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2861	45.6666	47.1888	49.2861	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (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	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (64)
Heat gains from water heating, kWh/month	68.5473	60.3165	63.1070	56.2401	54.4555	47.7751	45.4886	50.9829	51.4519	58.3340	62.0985	66.7864 (65)
Solar input (sum of months) = Sum (63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum (64)m = 2208.1083 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	92.1335	89.7568	84.8212	78.1113	73.1929	66.3543	61.1407	68.5255	71.4610	78.4059	86.2479	89.7667	(72)
Total internal gains	486.0943	483.6504	466.2993	438.1522	408.5190	380.3102	362.7972	370.2491	385.6002	413.9823	446.5392	471.4281	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				0.6000	10.6334	0.6300		0.7000		0.7700		1.9498 (74)	
East				8.1100	19.6403	0.6300		0.7000		0.7700		48.6788 (76)	
West				10.0700	19.6403	0.6300		0.7000		0.7700		60.4434 (80)	
Solar gains	111.0720	217.1923	357.8800	522.8826	642.0486	657.8928	626.0707	536.8871	416.4780	257.7311	138.4679	91.3622	(83)
Total gains	597.1663	700.8428	824.1794	961.0348	1050.5675	1038.2030	988.8679	907.1362	802.0782	671.7134	585.0071	562.7904	(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	62.6565	62.8040	62.9492	63.6405	63.7715	64.3886	64.3886	64.5042	64.1495	63.7715	63.5070	63.2328	
alpha	5.1771	5.1869	5.1966	5.2427	5.2514	5.2926	5.2926	5.3003	5.2766	5.2514	5.2338	5.2155	
util living area	0.9994	0.9985	0.9949	0.9777	0.9161	0.7701	0.5993	0.6676	0.9068	0.9908	0.9987	0.9996	(86)
MIT	19.6864	19.8283	20.0871	20.4382	20.7470	20.9331	20.9857	20.9756	20.8260	20.4145	19.9876	19.6643	(87)
Th 2	19.9940	19.9962	19.9982	20.0080	20.0099	20.0184	20.0184	20.0200	20.0151	20.0099	20.0062	20.0023	(88)
util rest of house	0.9992	0.9980	0.9929	0.9684	0.8807	0.6838	0.4756	0.5430	0.8527	0.9857	0.9982	0.9994	(89)
MIT 2	18.2244	18.4335	18.8127	19.3261	19.7491	19.9711	20.0128	20.0091	19.8619	19.2987	18.6741	18.1980	(90)
Living area fraction	18.4031	18.6040	18.9684	19.4620	19.8711	20.0887	20.1317	20.1273	19.9797	19.4351	18.8346	18.3772	(91)
MIT	18.4031	18.6040	18.9684	19.4620	19.8711	20.0887	20.1317	20.1273	19.9797	19.4351	18.8346	18.3772	(92)
Temperature adjustment	18.4031	18.6040	18.9684	19.4620	19.8711	20.0887	20.1317	20.1273	19.9797	19.4351	18.8346	18.3772	(93)
adjusted MIT	18.4031	18.6040	18.9684	19.4620	19.8711	20.0887	20.1317	20.1273	19.9797	19.4351	18.8346	18.3772	(93)

8. Space heating requirement

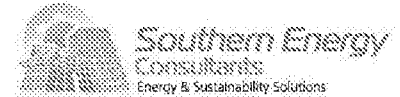
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9987	0.9969	0.9899	0.9615	0.8747	0.6906	0.4905	0.5576	0.8502	0.9813	0.9972	0.9991	(94)
Ext temp.	596.3928	698.6369	815.8897	924.0735	918.9016	717.0002	485.0448	505.7944	681.9540	659.1635	583.3668	562.2575	(95)
Heat loss rate 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	2015.7676	1954.1213	1773.8380	1486.2999	1147.4793	763.4025	491.2130	517.4796	820.8361	1240.7242	1654.7725	2007.8957	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1056.0148	843.6855	712.7135	404.8030	170.0618	0.0000	0.0000	0.0000	0.0000	432.6812	771.4121	1075.5548	(98)
Space heating per m2												5466.9268	(98)
												(98) / (4) =	42.3924 (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

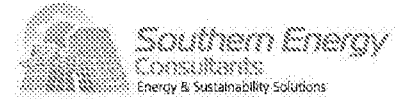
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5853.2407 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1056.0148	843.6855	712.7135	404.8030	170.0618	0.0000	0.0000	0.0000	0.0000	432.6812	771.4121	1075.5548 (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)	1130.6369	903.3035	763.0766	433.4079	182.0790	0.0000	0.0000	0.0000	0.0000	463.2561	825.9231	1151.5576 (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	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (64)
Efficiency of water heater (217)m	88.4897	88.3331	87.9529	87.0135	84.9649	80.3000	80.3000	80.3000	80.3000	87.0814	88.1270	88.5552 (217)
Fuel for water heating, kWh/month	247.2619	218.2913	230.1679	208.4496	207.1502	193.0452	184.9520	206.1782	207.9436	215.9871	225.8088	241.0987 (219)
Water heating fuel used												2586.3345 (219)
Annual totals kWh/year												
Space heating fuel - main system												5853.2407 (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)												496.5096 (232)
Total delivered energy for all uses												9011.0848 (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	5853.2407	0.2160	1264.3000 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2586.3345	0.2160	558.6483 (264)
Space and water heating			1822.9482 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total CO2, kg/m2/year			2119.5617 (272)
Emissions per m2 for space and water heating			14.1358 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9982 (272b)
Emissions per m2 for pumps and fans			0.3018 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1358 * 1.00) + 1.9982 + 0.3018, rounded to 2 d.p.			16.4400 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			9.0000	580.3200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23314.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.7902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss							(33) + (36) = 92.6136 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.6446	152.3090	151.9800	150.4347	150.1456	148.7997	148.7997	148.5504	149.3181	150.1456	150.7305	151.3419 (39)
Average = Sum(39)m / 12 =												150.4333 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1837	1.1811	1.1785	1.1665	1.1643	1.1538	1.1538	1.1519	1.1579	1.1643	1.1688	1.1736 (40)
HLP (average)												1.1665 (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	2.8922 (42)
Average daily hot water use (litres/day)	102.8908 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

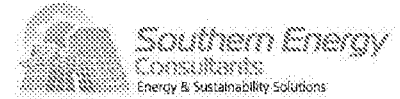
Elmhurst Energy Systems

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 = 1618.8725 (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	35.6665	31.1942	32.1896	28.0637	26.9278	23.2366	21.5321	24.7084	25.0035	29.1392	31.8077	34.5411 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	47.9389	46.4199	43.2656	38.9773	36.1932	32.2731	28.9410	33.2103	34.7271	39.1656	44.1774	46.4262	(72)
Total internal gains	438.8996	437.3136	421.7437	396.0182	368.5193	343.2289	327.5976	331.9339	345.8663	371.7420	401.4687	425.0877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6000	10.6334	0.4400	0.0000	0.7700	2.1616 (74)
East	8.1100	19.6403	0.4400	0.0000	0.7700	53.9649 (76)
West	10.0700	19.6403	0.4400	0.0000	0.7700	67.0070 (80)

Solar gains	123.1335	240.7776	396.7428	579.6633	711.7696	729.3345	694.0568	595.1885	461.7040	285.7185	153.5043	101.2834	(83)
Total gains	562.0331	678.0912	818.4865	975.6815	1080.2889	1072.5634	1021.6543	927.1224	807.5703	657.4605	554.9730	526.3711	(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	42.4274	42.5209	42.6129	43.0506	43.1335	43.5237	43.5237	43.5967	43.3726	43.1335	42.9662	42.7926	
alpha	3.8285	3.8347	3.8409	3.8700	3.8756	3.9016	3.9016	3.9064	3.8915	3.8756	3.8644	3.8528	
util living area	0.9976	0.9948	0.9859	0.9564	0.8827	0.7462	0.5951	0.6612	0.8797	0.9794	0.9957	0.9982	(86)
MIT	19.1606	19.3546	19.7064	20.1761	20.5886	20.8584	20.9565	20.9345	20.7023	20.1474	19.5681	19.1297	(87)
Th 2	19.9331	19.9352	19.9372	19.9469	19.9487	19.9571	19.9571	19.9587	19.9539	19.9487	19.9450	19.9412	(88)
util rest of house	0.9970	0.9934	0.9819	0.9432	0.8454	0.6650	0.4732	0.5410	0.8258	0.9712	0.9943	0.9977	(89)
MIT 2	18.2440	18.4391	18.7902	19.2581	19.6465	19.8790	19.9421	19.9335	19.7610	19.2377	18.6601	18.2193	(90)
Living area fraction	fLA = Living area / (4) =												0.1222 (91)
MIT	18.3560	18.5510	18.9022	19.3703	19.7616	19.9987	20.0660	20.0558	19.8761	19.3489	18.7710	18.3305	(92)
Temperature adjustment													0.0000
adjusted MIT	18.3560	18.5510	18.9022	19.3703	19.7616	19.9987	20.0660	20.0558	19.8761	19.3489	18.7710	18.3305	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	559.5718	671.8421	799.3469	911.2497	904.7049	717.1334	497.3613	513.0522	662.9045	634.2035	550.5569	524.5790	(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	2145.5777	2079.1631	1884.8812	1575.1011	1210.4124	803.3190	515.7457	543.0719	862.4711	1313.6042	1759.1808	2138.5413	(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	1179.9884	945.7197	807.6375	477.9730	227.4464	0.0000	0.0000	0.0000	0.0000	505.4742	870.2091	1200.7880	(98)
Space heating													6215.2363 (98)
Space heating per m2													(98) / (4) = 48.1951 (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	1398.7169	1101.1176	1128.9833	0.0000	0.0000	0.0000	0.0000 (100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

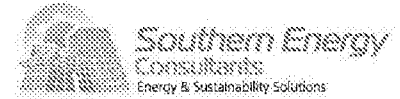


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7884	0.8589	0.8205	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1102.7861	945.7144	926.3265	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1372.6405	1310.5048	1202.4807	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	194.2951	271.4041	205.4587	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			671.1579 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	48.5738	67.8510	51.3647	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												167.7895 (107)
Energy for space heating												1.3011 (108)
Energy for space cooling												48.1951 (99)
Total												1.3011 (108)
Dwelling Fabric Energy Efficiency (DFEE)												49.4962 (109)
												49.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER 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)			18.7800	1.3258	24.8977		(27)
Heat Loss Floor 1			64.4800	0.1300	8.3824		(28a)
Brick Cavity	131.1300	15.7100	115.4200	0.1800	20.7756		(29a)
Flint Cavity	26.1300	7.3700	18.7600	0.1800	3.3768		(29a)
Main Plane	64.4800		64.4800	0.1300	8.3824		(30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.5449		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3550 (36)
Total fabric heat loss						(33) + (36) =	82.8999 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	142.9310	142.5953	142.2663	140.7210	140.4319	139.0860	139.0860	138.8368	139.6044	140.4319	141.0168	141.6283 (39)
Average = Sum(39)m / 12 =												140.7196 (39)
HLP	1.1083	1.1057	1.1032	1.0912	1.0890	1.0785	1.0785	1.0766	1.0825	1.0890	1.0935	1.0982 (40)
HLP (average)												1.0912 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)
Energy content (annual)										Total = Sum(45)m =		1618.8725 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	35.6665	31.1942	32.1896	28.0637	26.9278	23.2366	21.5321	24.7084	25.0035	29.1392	31.8077	34.5411 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	47.9389	46.4199	43.2656	38.9773	36.1932	32.2731	28.9410	33.2103	34.7271	39.1656	44.1774	46.4262	(72)
Total internal gains	438.8996	437.3136	421.7437	396.0182	368.5193	343.2289	327.5976	331.9339	345.8663	371.7420	401.4687	425.0877	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	0.6000	10.6334	0.6300		0.7000	0.7700	1.9498 (74)
East	8.1100	19.6403	0.6300		0.7000	0.7700	48.6788 (76)
West	10.0700	19.6403	0.6300		0.7000	0.7700	60.4434 (80)

Solar gains	111.0720	217.1923	357.8800	522.8826	642.0486	657.8928	626.0707	536.8871	416.4780	257.7311	138.4679	91.3622 (83)
Total gains	549.9716	654.5059	779.6238	918.9008	1010.5678	1001.1218	953.6683	868.8210	762.3443	629.4731	539.9365	516.4499 (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	62.6565	62.8040	62.9492	63.6405	63.7715	64.3886	64.3886	64.5042	64.1495	63.7715	63.5070	63.2328	
alpha	5.1771	5.1869	5.1966	5.2427	5.2514	5.2926	5.2926	5.3003	5.2766	5.2514	5.2338	5.2155	
util living area	0.9996	0.9989	0.9960	0.9815	0.9263	0.7879	0.6183	0.6906	0.9211	0.9931	0.9991	0.9997	(86)
MIT	19.6518	19.7945	20.0552	20.4105	20.7276	20.9252	20.9835	20.9715	20.8075	20.3848	19.9546	19.6303	(87)
Th 2	19.9940	19.9962	19.9982	20.0080	20.0099	20.0184	20.0184	20.0200	20.0151	20.0099	20.0062	20.0023	(88)
util rest of house	0.9995	0.9986	0.9945	0.9736	0.8939	0.7031	0.4922	0.5646	0.8723	0.9892	0.9988	0.9996	(89)
MIT 2	18.7513	18.8956	19.1572	19.5159	19.8157	19.9817	20.0139	20.0111	19.8966	19.4953	19.0638	18.7364	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.8614	19.0054	19.2669	19.6252	19.9272	20.0970	20.1324	20.1285	20.0079	19.6040	19.1726	18.8457	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8614	19.0054	19.2669	19.6252	19.9272	20.0970	20.1324	20.1285	20.0079	19.6040	19.1726	18.8457	(93)

8. Space heating requirement

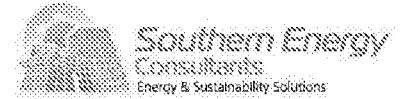
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9993	0.9980	0.9929	0.9696	0.8906	0.7106	0.5076	0.5797	0.8718	0.9869	0.9983	0.9995	(94)
Ext temp.	549.5596	653.1987	774.1041	890.9817	900.0022	711.4418	484.0804	503.6682	664.6314	621.2576	539.0313	516.1748	(95)
Heat loss rate 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	2081.2698	2011.3670	1816.3053	1509.2679	1155.3545	764.5534	491.3115	517.6506	824.7668	1264.4464	1702.4452	2074.2416	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1139.5924	912.6891	775.3977	445.1661	189.9821	0.0000	0.0000	0.0000	0.0000	478.5324	837.6580	1159.2016	(98)
Space heating per m ²												5938.2194	(98)
										(98) / (4) =		46.0470	(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	1307.4084	1029.2364	1055.1593	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8351	0.9060	0.8701	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1091.8232	932.4604	918.0644	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1289.1373	1231.0406	1134.3362	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

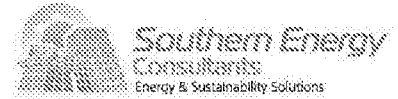


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	142.0661	222.1437	160.9063	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												525.1161 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	35.5165	55.5359	40.2266	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												131.2790 (107)
Space cooling per m2												1.0180 (108)
Energy for space heating												46.0470 (99)
Energy for space cooling												1.0180 (108)
Total												47.0650 (109)
Target Fabric Energy Efficiency (TFEE)												54.1 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.6136 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.8631	149.3181	149.3181	148.5504	148.5504	147.6199	147.8426	147.4039	147.6199	148.0719	148.0719	148.7997 (39)
Average = Sum(39)m / 12 =												148.4192 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1621	1.1579	1.1579	1.1519	1.1519	1.1447	1.1464	1.1430	1.1447	1.1482	1.1482	1.1538 (40)
HLP (average)												1.1509 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

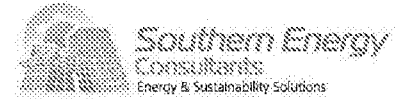
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457 (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)												
	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897 (71)
Water heating gains (Table 5)												
	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970 (72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				0.6000	11.9814	0.4400	0.0000	0.7700		2.4356 (74)		
East				8.1100	22.3313	0.4400	0.0000	0.7700		61.3590 (76)		
West				10.0700	22.3313	0.4400	0.0000	0.7700		76.1881 (80)		
Solar gains	139.9827	246.2597	400.1865	600.9384	717.4609	786.1561	740.2745	650.1655	504.2837	311.8734	178.7857	114.0204 (83)
Total gains	848.6091	949.2380	1074.9916	1232.0553	1303.4117	1332.2594	1263.5854	1183.4386	1063.1663	914.6796	830.2466	802.7057 (84)

7. Mean internal temperature (heating season)

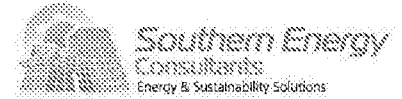
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.2905	44.4521	44.4521	44.6819	44.6819	44.9635	44.8958	45.0294	44.9635	44.8263	44.8263	44.6070
alpha	3.9527	3.9635	3.9635	3.9788	3.9788	3.9976	3.9931	4.0020	3.9976	3.9884	3.9884	3.9738
util living area	0.9891	0.9822	0.9605	0.8964	0.7607	0.5294	0.3587	0.3925	0.7055	0.9267	0.9798	0.9910 (86)
MIT	19.5907	19.7504	20.0877	20.5017	20.8197	20.9700	20.9953	20.9934	20.9027	20.5015	19.9819	19.5633 (87)
Th 2	19.9504	19.9539	19.9539	19.9587	19.9587	19.9645	19.9631	19.9659	19.9645	19.9617	19.9617	19.9571 (88)
util rest of house	0.9862	0.9775	0.9497	0.8681	0.6978	0.4299	0.2408	0.2687	0.6124	0.8998	0.9735	0.9886 (89)
MIT 2	18.0934	18.3269	18.8113	19.3894	19.7922	19.9478	19.9620	19.9642	19.8943	19.4047	18.6698	18.0582 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2763	18.5009	18.9672	19.5253	19.9178	20.0727	20.0883	20.0900	20.0176	19.5388	18.8302	18.2422 (92)
Temperature adjustment												
adjusted MIT	18.1263	18.3509	18.8172	19.3753	19.7678	19.9227	19.9383	19.9400	19.8676	19.3888	18.6802	18.0922 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9787	0.9672	0.9339	0.8486	0.6848	0.4257	0.2379	0.2656	0.6026	0.8802	0.9621	0.9820 (94)
Useful gains	830.4985	918.0874	1003.9346	1045.4865	892.5679	567.1760	300.5987	314.2739	640.6682	805.1371	798.7993	788.2458 (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												
	1952.1677	1903.9346	1704.8014	1407.5625	1005.3539	579.0692	301.3490	315.4403	689.0241	1153.2993	1581.4311	1933.2296 (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												
	834.5219	662.4893	521.4448	260.6947	83.9128	0.0000	0.0000	0.0000	0.0000	259.0326	563.4949	851.8679 (98)
Space heating												
RHI space heating demand												4037.4590 (98)
												4037 (98)

FULL SAP CALCULATION PRINTOUT

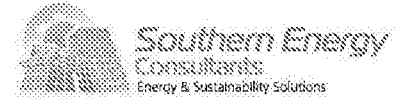
Calculation Type: New Build (As Designed)



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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.6136 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.6446	152.3090	151.9800	150.4347	150.1456	148.7997	148.7997	148.5504	149.3181	150.1456	150.7305	151.3419 (39)
Average = Sum(39)m / 12 =												150.4333 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1837	1.1811	1.1785	1.1665	1.1643	1.1538	1.1538	1.1519	1.1579	1.1643	1.1688	1.1736 (40)
HLP (average)												1.1665 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

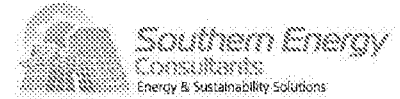
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

North	0.6000	10.6334	0.4400	0.0000	0.7700	2.1616 (74)
East	8.1100	19.6403	0.4400	0.0000	0.7700	53.9649 (76)
West	10.0700	19.6403	0.4400	0.0000	0.7700	67.0070 (80)

Solar gains	123.1335	240.7776	396.7428	579.6633	711.7696	729.3345	694.0568	595.1885	461.7040	285.7185	153.5043	101.2834	(83)
Total gains	831.7598	943.7559	1071.5479	1210.7803	1297.7204	1275.4378	1217.3677	1128.4616	1020.5866	888.5247	804.9653	789.9687	(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	43.4834	43.5792	43.6736	44.1222	44.2072	44.6070	44.6070	44.6819	44.4521	44.2072	44.0356	43.8577
alpha	3.8989	3.9053	3.9116	3.9415	3.9471	3.9738	3.9738	3.9788	3.9635	3.9471	3.9357	3.9238
util living area	0.9914	0.9851	0.9685	0.9225	0.8260	0.6693	0.5157	0.5702	0.8023	0.9504	0.9856	0.9930 (86)
MIT	19.4331	19.6158	19.9394	20.3585	20.7039	20.9098	20.9753	20.9635	20.8067	20.3456	19.8132	19.3989 (87)
Th 2	19.9331	19.9352	19.9372	19.9469	19.9487	19.9571	19.9571	19.9587	19.9539	19.9487	19.9450	19.9412 (88)
util rest of house	0.9892	0.9813	0.9602	0.9015	0.7788	0.5849	0.4032	0.4560	0.7325	0.9326	0.9813	0.9912 (89)
MIT 2	17.8524	18.1191	18.5872	19.1849	19.6442	19.8886	19.9455	19.9398	19.7845	19.1801	18.4145	17.8080 (90)
Living area fraction	18.0456	18.3020	18.7524	19.3283	19.7737	20.0134	20.0714	20.0649	19.9094	19.3225	18.5854	18.0024 (91)
MIT	18.0456	18.3020	18.7524	19.3283	19.7737	20.0134	20.0714	20.0649	19.9094	19.3225	18.5854	18.0024 (92)
Temperature adjustment	17.8956	18.1520	18.6024	19.1783	19.6237	19.8634	19.9214	19.9149	19.7594	19.1725	18.4354	-0.1500
adjusted MIT	17.8956	18.1520	18.6024	19.1783	19.6237	19.8634	19.9214	19.9149	19.7594	19.1725	18.4354	17.8524 (93)

8. Space heating requirement

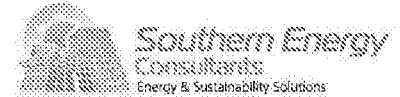
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	817.4922	917.3101	1013.4112	1067.9317	988.6124	735.4427	485.9594	508.7809	731.9315	812.6777	782.4016	778.6508	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2075.2924	2018.3987	1839.3235	1546.2188	1189.7046	783.1946	494.2179	522.1397	845.0517	1287.1258	1708.5903	2066.1791	(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	935.8033	739.9316	614.4788	344.3667	149.6126	0.0000	0.0000	0.0000	0.0000	352.9894	666.8559	957.9211	(98)
Space heating												4761.9593	(98)
Space heating per m2												36.9259	(99)

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

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													5261.8335 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	935.8033	739.9316	614.4788	344.3667	149.6126	0.0000	0.0000	0.0000	0.0000	352.9894	666.8559	957.9211	(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)	1034.0368	817.6039	678.9821	380.5157	165.3177	0.0000	0.0000	0.0000	0.0000	390.0435	736.8573	1058.4763	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9631	89.9153	89.8012	89.5244	88.9199	87.3000	87.3000	87.3000	87.3000	89.5160	89.8520	89.9863	(217)
Fuel for water heating, kWh/month	202.3072	177.4711	184.4079	162.7423	158.3104	140.7841	132.0841	149.2571	150.3538	168.9211	181.8051	196.3555	(219)
Water heating fuel used													2004.7996 (219)
Annual totals kWh/year													
Space heating fuel - main system													5261.8335 (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)													496.5096 (232)
Total delivered energy for all uses													7838.1426 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5261.8335	3.4800	183.1118 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.7996	3.4800	69.7670 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	496.5096	13.1900	65.4896 (250)
Additional standing charges			120.0000 (251)
Total energy cost			448.2609 (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] =	1.0823 (257)
SAP value		84.9025
SAP rating (Section 12)		85 (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	5261.8335	0.2160	1136.5560 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.7996	0.2160	433.0367 (264)
Space and water heating			1569.5927 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1866.2062 (272)
CO2 emissions per m2			14.4700 (273)
EI value			85.6248
EI rating			86 (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	$3.48 / 0.8889 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8889 = 0.2430$, stars = 4

Regs Region: England

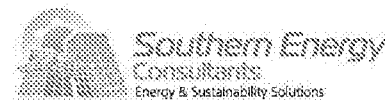
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.6136 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.8631	149.3181	149.3181	148.5504	148.5504	147.6199	147.8426	147.4039	147.6199	148.0719	148.0719	148.7997 (39)
Average = Sum(39)m / 12 =												148.4192 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1621	1.1579	1.1579	1.1519	1.1519	1.1447	1.1464	1.1430	1.1447	1.1482	1.1482	1.1538 (40)
HLP (average)												1.1509 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

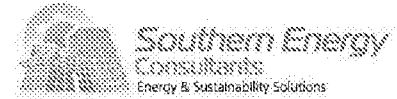
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (65)
Total per year (kWh/year) = Sum(64)m =	1784.6736 (64)										

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North				0.6000	11.9814	0.4400	0.0000			0.7700	2.4356 (74)	
East				8.1100	22.3313	0.4400	0.0000			0.7700	61.3590 (76)	
West				10.0700	22.3313	0.4400	0.0000			0.7700	76.1881 (80)	
Solar gains	139.9827	246.2597	400.1865	600.9384	717.4609	786.1561	740.2745	650.1655	504.2837	311.8734	178.7857	114.0204 (83)
Total gains	848.6091	949.2380	1074.9916	1232.0553	1303.4117	1332.2594	1263.5854	1183.4386	1063.1663	914.6796	830.2466	802.7057 (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	44.2905	44.4521	44.4521	44.6819	44.6819	44.9635	44.8958	45.0294	44.9635	44.8263	44.8263	44.6070
alpha	3.9527	3.9635	3.9635	3.9788	3.9788	3.9976	3.9931	4.0020	3.9976	3.9884	3.9884	3.9738
util living area	0.9891	0.9822	0.9605	0.8964	0.7607	0.5294	0.3587	0.3925	0.7055	0.9267	0.9798	0.9910 (86)
MIT	19.5907	19.7504	20.0877	20.5017	20.8197	20.9700	20.9953	20.9934	20.9027	20.5015	19.9819	19.5633 (87)
Th 2	19.9504	19.9539	19.9539	19.9587	19.9587	19.9645	19.9631	19.9659	19.9645	19.9617	19.9617	19.9571 (88)
util rest of house	0.9862	0.9775	0.9497	0.8681	0.6978	0.4299	0.2408	0.2687	0.6124	0.8998	0.9735	0.9886 (89)
MIT 2	18.0934	18.3269	18.8113	19.3894	19.7922	19.9478	19.9620	19.9642	19.8943	19.4047	18.6698	18.0582 (90)
Living area fraction	18.2763	18.5009	18.9672	19.5253	19.9178	20.0727	20.0883	20.0900	20.0176	19.5388	18.8302	18.2422 (91)
MIT	18.1263	18.3509	18.8172	19.3753	19.7678	19.9227	19.9383	19.9400	19.8676	19.3888	18.6802	18.0922 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1263	18.3509	18.8172	19.3753	19.7678	19.9227	19.9383	19.9400	19.8676	19.3888	18.6802	18.0922 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9787	0.9672	0.9339	0.8486	0.6848	0.4257	0.2379	0.2656	0.6026	0.8802	0.9621	0.9820	(94)
Useful gains	830.4985	918.0874	1003.9346	1045.4865	892.5679	567.1760	300.5987	314.2739	640.6682	805.1371	798.7993	788.2458	(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	1952.1677	1903.9346	1704.8014	1407.5625	1005.3539	579.0692	301.3490	315.4403	689.0241	1153.2993	1581.4311	1933.2296	(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	834.5219	662.4893	521.4448	260.6947	83.9128	0.0000	0.0000	0.0000	0.0000	259.0326	563.4949	851.8679	(98)
Space heating												4037.4590	(98)
Space heating per m2												(98) / (4) = 31.3078	(99)

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

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													4461.2806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	834.5219	662.4893	521.4448	260.6947	83.9128	0.0000	0.0000	0.0000	0.0000	259.0326	563.4949	851.8679	(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)	922.1236	732.0324	576.1822	288.0605	92.7213	0.0000	0.0000	0.0000	0.0000	286.2239	622.6463	941.2905	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	89.9099	89.8606	89.7074	89.3261	88.4683	87.3000	87.3000	87.3000	87.3000	89.2936	89.7605	89.9337	(216)	
Fuel for water heating, kWh/month	202.4268	177.5791	184.6007	163.1035	159.1186	140.7841	132.0841	149.2571	150.3538	169.3417	181.9902	196.4704	(219)	
Water heating fuel used	2007.1101											2007.1101	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4461.2806	(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)												496.5096	(232)	
Total delivered energy for all uses												7039.9003	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4461.2806	3.8700	172.6516 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2007.1101	3.8700	77.6752 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	496.5096	18.9000	93.8403 (250)
Additional standing charges			93.0000 (251)
Total energy cost			451.3420 (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	4461.2806	0.2160	963.6366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.1101	0.2160	433.5358 (264)
Space and water heating			1397.1724 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1693.7859 (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	4461.2806	1.2200	5442.7624 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.1101	1.2200	2448.6744 (264)
Space and water heating			7891.4367 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	496.5096	3.0700	1524.2844 (268)
Primary energy kWh/year			9645.9712 (272)
Primary energy kWh/m2/year			74.7982 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
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	SAP increase too small
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
U Solar photovoltaic panels	+ 7.7	-£ 345	-947 kg (55.9%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 30	-193 kg (11.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£345	7.34 kg/m²	A 93
Total Savings	£345	7.34 kg/m²	A 93
Potential energy efficiency rating:		A 93	
Potential environmental impact rating:			A 93

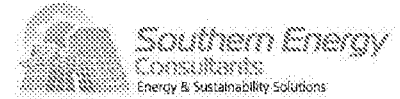
Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£108	£108	£0
Mains gas	£343	£343	£0
Space heating	£280	£280	£0
Water heating	£78	£78	£0
Lighting	£94	£94	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£451	£106	£345
Total cost of uses	£452	£107	£345
Delivered energy	55 kWh/m²	40 kWh/m²	14 kWh/m²
Carbon dioxide emissions	1.7 tonnes	0.7 tonnes	0.9 tonnes
CO2 emissions per m²	13 kg/m²	6 kg/m²	7 kg/m²
Primary energy	75 kWh/m²	31 kWh/m²	43 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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.6136 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.6446	152.3090	151.9800	150.4347	150.1456	148.7997	148.7997	148.5504	149.3181	150.1456	150.7305	151.3419 (39)
Average = Sum(39)m / 12 =												150.4333 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1837	1.1811	1.1785	1.1665	1.1643	1.1538	1.1538	1.1519	1.1579	1.1643	1.1688	1.1736 (40)
HLP (average)												1.1665 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

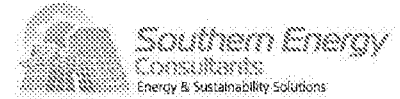
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W			
North				0.6000	10.6334	0.4400	0.0000	0.7700		2.1616 (74)			
East				8.1100	19.6403	0.4400	0.0000	0.7700		53.9649 (76)			
West				10.0700	19.6403	0.4400	0.0000	0.7700		67.0070 (80)			
Solar gains	123.1335	240.7776	396.7428	579.6633	711.7696	729.3345	694.0568	595.1885	461.7040	285.7185	153.5043	101.2834	(83)
Total gains	831.7598	943.7559	1071.5479	1210.7803	1297.7204	1275.4378	1217.3677	1128.4616	1020.5866	888.5247	804.9653	789.9687	(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	43.4834	43.5792	43.6736	44.1222	44.2072	44.6070	44.6070	44.6819	44.4521	44.2072	44.0356	43.8577
alpha	3.8989	3.9053	3.9116	3.9415	3.9471	3.9738	3.9738	3.9788	3.9635	3.9471	3.9357	3.9238
util living area	0.9914	0.9851	0.9685	0.9225	0.8260	0.6693	0.5157	0.5702	0.8023	0.9504	0.9856	0.9930 (86)
MIT	19.4331	19.6158	19.9394	20.3585	20.7039	20.9098	20.9753	20.9635	20.8067	20.3456	19.8132	19.3989 (87)
Th 2	19.9331	19.9352	19.9372	19.9469	19.9487	19.9571	19.9571	19.9587	19.9539	19.9487	19.9450	19.9412 (88)
util rest of house	0.9892	0.9813	0.9602	0.9015	0.7788	0.5849	0.4032	0.4560	0.7325	0.9326	0.9813	0.9912 (89)
MIT 2	17.8524	18.1191	18.5872	19.1849	19.6442	19.8886	19.9455	19.9398	19.7845	19.1801	18.4145	17.8080 (90)
Living area fraction	18.0456	18.3020	18.7524	19.3283	19.7737	20.0134	20.0714	20.0649	19.9094	19.3225	18.5854	18.0024 (91)
MIT	17.8956	18.1520	18.6024	19.1783	19.6237	19.8634	19.9214	19.9149	19.7594	19.1725	18.4354	17.8524 (92)
Temperature adjustment												-0.1500
adjusted MIT												17.8524 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	817.4922	917.3101	1013.4112	1067.9317	988.6124	735.4427	485.9594	508.7809	731.9315	812.6777	782.4016	778.6508	(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	2075.2924	2018.3987	1839.3235	1546.2188	1189.7046	783.1946	494.2179	522.1397	845.0517	1287.1258	1708.5903	2066.1791	(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	935.8033	739.9316	614.4788	344.3667	149.6126	0.0000	0.0000	0.0000	0.0000	352.9894	666.8559	957.9211	(98)
Space heating												4761.9593	(98)
Space heating per m2												36.9259	(99)

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

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													5261.8335 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	935.8033	739.9316	614.4788	344.3667	149.6126	0.0000	0.0000	0.0000	0.0000	352.9894	666.8559	957.9211	(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)	1034.0368	817.6039	678.9821	380.5157	165.3177	0.0000	0.0000	0.0000	0.0000	390.0435	736.8573	1058.4763	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9631	89.9153	89.8012	89.5244	88.9199	87.3000	87.3000	87.3000	87.3000	89.5160	89.8520	89.9863	(216)
Fuel for water heating, kWh/month	202.3072	177.4711	184.4079	162.7423	158.3104	140.7841	132.0841	149.2571	150.3538	168.9211	181.8051	196.3555	(219)
Water heating fuel used													2004.7996 (219)
Annual totals kWh/year													
Space heating fuel - main system													5261.8335 (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)													496.5096 (232)
Energy saving/generation technologies (Appendices M,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394			-1727.2394 (233)
Total delivered energy for all uses													6110.9032 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5261.8335	3.4800	183.1118 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.7996	3.4800	69.7670 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	496.5096	13.1900	65.4896 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			220.4381 (255)

11a. SAP rating - Individual heating systems

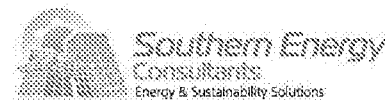
Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5322 (257)
SAP value		92.5756
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5261.8335	0.2160	1136.5560 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.7996	0.2160	433.0367 (264)
Space and water heating			1569.5927 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			969.7690 (272)
CO2 emissions per m2			7.5200 (273)
EI value			92.5299
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.4384 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	131.1300	15.7100	115.4200	0.2500	28.8550	60.0000	6925.2000 (29a)
Flint Cavity	26.1300	7.3700	18.7600	0.2500	4.6900	60.0000	1125.6000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5462		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.6136 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.8631	149.3181	149.3181	148.5504	148.5504	147.6199	147.8426	147.4039	147.6199	148.0719	148.0719	148.7997 (39)
Average = Sum(39)m / 12 =												148.4192 (39)

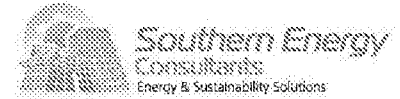
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1621	1.1579	1.1579	1.1519	1.1519	1.1447	1.1464	1.1430	1.1447	1.1482	1.1482	1.1538 (40)
HLP (average)												1.1509 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	0.6000				11.9814		0.4400		0.0000		0.7700		2.4356 (74)	
East	8.1100				22.3313		0.4400		0.0000		0.7700		61.3590 (76)	
West	10.0700				22.3313		0.4400		0.0000		0.7700		76.1881 (80)	
Solar gains	139.9827	246.2597	400.1865	600.9384	717.4609	786.1561	740.2745	650.1655	504.2837	311.8734	178.7857	114.0204	(83)	
Total gains	848.6091	949.2380	1074.9916	1232.0553	1303.4117	1332.2594	1263.5854	1183.4386	1063.1663	914.6796	830.2466	802.7057	(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	44.2905	44.4521	44.4521	44.6819	44.6819	44.9635	44.8958	45.0294	44.9635	44.8263	44.8263	44.6070
alpha	3.9527	3.9635	3.9635	3.9788	3.9788	3.9976	3.9931	4.0020	3.9976	3.9884	3.9884	3.9738
util living area	0.9891	0.9822	0.9605	0.8964	0.7607	0.5294	0.3587	0.3925	0.7055	0.9267	0.9798	0.9910 (86)
MIT	19.5907	19.7504	20.0877	20.5017	20.8197	20.9700	20.9953	20.9934	20.9027	20.5015	19.9819	19.5633 (87)
Th 2	19.9504	19.9539	19.9539	19.9587	19.9587	19.9645	19.9631	19.9659	19.9645	19.9617	19.9617	19.9571 (88)
util rest of house	0.9862	0.9775	0.9497	0.8681	0.6978	0.4299	0.2408	0.2687	0.6124	0.8998	0.9735	0.9886 (89)
MIT 2	18.0934	18.3269	18.8113	19.3894	19.7922	19.9478	19.9620	19.9642	19.8943	19.4047	18.6698	18.0582 (90)
Living area fraction	18.2763	18.5009	18.9672	19.5253	19.9178	20.0727	20.0883	20.0900	20.0176	19.5388	18.8302	18.2422 (92)
MIT	18.1263	18.3509	18.8172	19.3753	19.7678	19.9227	19.9383	19.9400	19.8676	19.3888	18.6802	18.0922 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9787	0.9672	0.9339	0.8486	0.6848	0.4257	0.2379	0.2656	0.6026	0.8802	0.9621	0.9820 (94)
Useful gains	830.4985	918.0874	1003.9346	1045.4865	892.5679	567.1760	300.5987	314.2739	640.6682	805.1371	798.7993	788.2458 (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	1952.1677	1903.9346	1704.8014	1407.5625	1005.3539	579.0692	301.3490	315.4403	689.0241	1153.2993	1581.4311	1933.2296 (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	834.5219	662.4893	521.4448	260.6947	83.9128	0.0000	0.0000	0.0000	0.0000	259.0326	563.4949	851.8679 (98)
Space heating												4037.4590 (98)
Space heating per m2												(98) / (4) = 31.3078 (99)

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

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													4461.2806 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	834.5219	662.4893	521.4448	260.6947	83.9128	0.0000	0.0000	0.0000	0.0000	259.0326	563.4949	851.8679	(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)	922.1236	732.0324	576.1822	288.0605	92.7213	0.0000	0.0000	0.0000	0.0000	286.2239	622.6463	941.2905	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9099	89.8606	89.7074	89.3261	88.4683	87.3000	87.3000	87.3000	87.3000	89.2936	89.7605	89.9337	(217)
Fuel for water heating, kWh/month	202.4268	177.5791	184.6007	163.1035	159.1186	140.7841	132.0841	149.2571	150.3538	169.3417	181.9902	196.4704	(219)
Water heating fuel used												2007.1101	(219)
Annual totals kWh/year													
Space heating fuel - main system												4461.2806	(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)												496.5096	(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												5215.7407	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4461.2806	3.8700	172.6516 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2007.1101	3.8700	77.6752 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	496.5096	18.9000	93.8403 (250)
Additional standing charges			93.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	18.9000	-344.7662 (252)
Total energy cost			106.5759 (255)

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

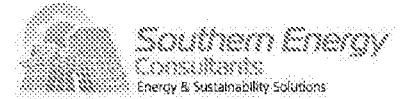
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4461.2806	0.2160	963.6366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.1101	0.2160	433.5358 (264)
Space and water heating			1397.1724 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			747.0470 (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	4461.2806	1.2200	5442.7624 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.1101	1.2200	2448.6744 (264)
Space and water heating			7891.4367 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	496.5096	3.0700	1524.2844 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			4045.8011 (272)
Primary energy kWh/m2/year			31.3725 (273)

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 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	185.3 (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	411.10 (P1)
Transmission heat loss coefficient	92.61 (37)
Summer heat loss coefficient	503.71 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.6000	81.1852	0.4400	0.0000	0.9000	19.2896
East	8.1100	117.5071	0.4400	0.0000	0.9000	377.3810
West	10.0700	117.5071	0.4400	0.0000	0.9000	468.5853
total:						865.2559

	Jun	Jul	Aug	
Solar gains	919	865	760	(P4)
Internal gains	543	520	530	
Total summer gains	1462	1386	1290	(P5)
Summer gain/loss ratio	2.90	2.75	2.56	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 185.3)	0.70	0.70	0.70	
Threshold temperature	19.61	21.35	21.06	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			