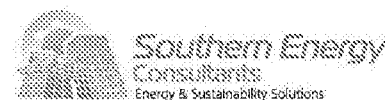


FULL SAP CALCULATION PRINTOUT

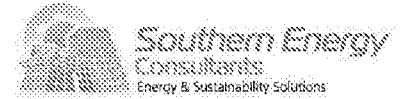
Calculation Type: New Build (As Designed)



Property Reference	SECANG006a		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Derwent, Plot 58				
SAP Rating	83 B	DER	18.27	TOT	18.59
Environmental	85 B	% DER<TER	1.72		
CO ₂ Emissions (t/year)	1.33	DFEE	51.88	TTEE	55.46
General Requirements Compliance	Pass	% DFEE<TTEE	6.45		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 88 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.27 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.9 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	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.35 (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:

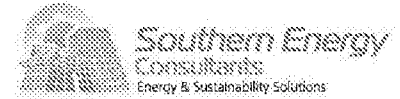
Overshading: Average
Windows facing North: 5.22 m², No overhang
Windows facing East: 0.83 m², No overhang
Windows facing South: 7.72 m², No overhang
Windows facing West: 0.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.038 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (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) = 0.1857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4357 (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) =	0.3704 (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	0.4722	0.4630	0.4537	0.4074	0.3982	0.3519	0.3519	0.3426	0.3704	0.3982	0.4167	0.4352 (22b)
Effective ac	0.6115	0.6072	0.6029	0.5630	0.5793	0.5619	0.5619	0.5587	0.5686	0.5793	0.5868	0.5947 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17698.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 200.1153 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5520 (36)
Total fabric heat loss (33) + (36) = 75.7678 (37)

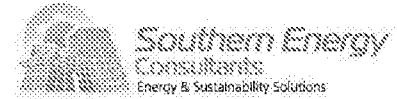
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	43.4571	43.1494	42.8478	41.4311	41.1661	39.9322	39.9322	39.7037	40.4075	41.1661	41.7023	42.2628 (38)
Heat transfer coeff	119.2249	118.9172	118.6156	117.1989	116.9339	115.7000	115.7000	115.4715	116.1753	116.9339	117.4701	118.0306 (39)
Average = Sum(39)m / 12 =												117.1976 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3481	1.3446	1.3412	1.3252	1.3222	1.3082	1.3082	1.3056	1.3136	1.3222	1.3282	1.3346 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)										Total = Sum(45)m =		1511.0721 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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	14.1326	12.7541	14.0890	13.5912	14.0128	13.5245	13.9528	13.9917	13.5609	14.0575	13.6481	14.1207 (61)
Total heat required for water heating calculated for each month	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (64)
Heat gains from water heating, kWh/month	55.6245	48.7480	50.5355	44.3851	42.8315	37.3185	34.9361	39.5849	39.9082	46.0725	49.8676	53.9779 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1676.5080 (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	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9007	19.4520	15.8194	11.9763	8.9525	7.5580	8.1667	10.6154	14.2480	18.0911	21.1150	22.5094 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.1783	238.6291	232.4532	219.3054	202.7086	187.1101	176.6892	174.2385	180.4144	193.5622	210.1589	225.7575 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188 (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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504 (71)
Water heating gains (Table 5)	74.7642	72.5417	67.9241	61.6460	57.5693	51.8312	46.9572	53.2055	55.4280	61.9254	69.2605	72.5510 (72)
Total internal gains	397.8996	395.6792	381.2531	357.9841	334.2867	311.5557	296.8695	303.1158	315.1468	338.6351	365.5908	385.8742 (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					5.2200	10.6334	0.4400	0.0000	0.7700	18.8055 (74)		
East					0.8300	19.6403	0.4400	0.0000	0.7700	5.5229 (76)		
South					7.7200	46.7521	0.4400	0.0000	0.7700	122.2817 (78)		
West					0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)		
Solar gains	150.6026	254.8184	346.8261	431.1212	487.3785	486.6877	467.9762	425.0036	375.5619	280.8727	180.0092	129.1649 (83)
Total gains	548.5022	650.4976	728.0792	789.1053	821.6652	798.2434	764.8458	728.1194	690.7087	619.5078	545.6000	515.0391 (84)

7. Mean internal temperature (heating season)

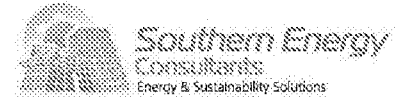
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.2344	41.3411	41.4462	41.9472	42.0423	42.4906	42.4906	42.5747	42.3168	42.0423	41.8504	41.6516
alpha	3.7490	3.7561	3.7631	3.7965	3.8028	3.8327	3.8327	3.8383	3.8211	3.8028	3.7900	3.7768
util living area	0.9942	0.9885	0.9769	0.9490	0.8862	0.7623	0.6112	0.6544	0.8471	0.9607	0.9895	0.9954 (86)
MIT	19.2521	19.4616	19.7788	20.1870	20.5632	20.8391	20.9493	20.9333	20.7363	20.2452	19.6731	19.2175 (87)
Th 2	19.8034	19.8061	19.8087	19.8212	19.8235	19.8344	19.8344	19.8364	19.8302	19.8235	19.8188	19.8138 (88)
util rest of house	0.9926	0.9852	0.9700	0.9322	0.8450	0.6725	0.4726	0.5195	0.7777	0.9444	0.9859	0.9941 (89)
MIT 2	17.4944	17.8006	18.2617	18.8527	19.3684	19.7115	19.8116	19.8033	19.6010	18.9450	18.1187	17.4505 (90)
Living area fraction	17.7666	18.0579	18.4967	19.0594	19.5535	19.8862	19.9879	19.9783	19.7768	19.1464	18.3595	17.7242 (92)
MIT	17.6166	17.9079	18.3467	18.9094	19.4035	19.7362	19.8379	19.8283	19.6268	18.9964	18.2095	17.5742 (93)
Temperature adjustment												-0.1500
adjusted MIT												17.5742 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9877	0.9772	0.9576	0.9146	0.8265	0.6637	0.4731	0.5184	0.7627	0.9281	0.9783	0.9901 (94)
Ext temp.	541.7810	635.6951	697.1833	721.7138	679.1378	529.7559	361.8189	377.4899	526.8093	574.9460	533.7696	509.9659 (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	1587.6748	1546.8634	1405.1991	1173.0864	900.7998	594.2544	374.6211	395.8723	642.0821	981.8246	1305.0289	1578.5700 (97)
Space heating kWh	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 per m2	778.1450	612.3051	526.7637	324.9883	164.9166	0.0000	0.0000	0.0000	0.0000	302.7176	555.3067	795.0414 (98)
												4060.1844 (98)
												(98) / (4) = 45.9089 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4486.3916	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	778.1450	612.3051	526.7637	324.9883	164.9166	0.0000	0.0000	0.0000	0.0000	302.7176	555.3067	795.0414	(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)	859.8287	676.5802	582.0594	359.1030	182.2283	0.0000	0.0000	0.0000	0.0000	334.4946	613.5985	878.4988	(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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432	(64)	
Efficiency of water heater (217)m	89.9068	89.8527	89.7503	89.5275	89.0471	87.3000	87.3000	87.3000	87.3000	89.4528	89.7878	89.9311	(217)	
Fuel for water heating, kWh/month	189.9727	166.6896	173.2389	152.8707	148.5657	132.4075	124.3219	140.3482	141.3395	158.8011	170.8074	184.4115	(219)	
Water heating fuel used												1883.7745	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4486.3916	(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)													386.7735	(232)
Total delivered energy for all uses													6831.9396	(238)

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

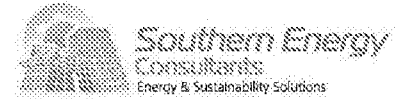
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4486.3916	0.2160	969.0606 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1883.7745	0.2160	406.8953 (264)
Space and water heating			1375.9559 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7735	0.5190	200.7355 (268)
Total CO2, kg/year			1615.6163 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2700 (273)

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

DER		18.2700	ZC1
Total Floor Area	TFA	88.4400	
Assumed number of occupants	N	2.6038	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.8248	ZC2
CO2 emissions from cooking, equation (L16)		2.0521	ZC3
Total CO2 emissions		36.1469	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		36.1469	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1393 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3893 (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) =	0.3309 (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	0.4219	0.4136	0.4054	0.3640	0.3557	0.3144	0.3144	0.3061	0.3309	0.3557	0.3723	0.3888 (22b)
Effective ac	0.5890	0.5855	0.5822	0.5662	0.5633	0.5494	0.5494	0.5468	0.5548	0.5633	0.5693	0.5756 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1500	1.0000	2.1500			(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800			(26a)					
TER Opening Type (Uw = 1.40)			14.3700	1.3258	19.0511			(27)					
Heat Loss Floor 1			44.2200	0.1300	5.7486			(28a)					
Brick Cavity	135.8700	18.6700	117.2000	0.1800	21.0960			(29a)					
Main Plane	44.2200		44.2200	0.1300	5.7486			(30)					
Total net area of external elements Aum(A, m2)			224.3100					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.3743		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.7128 (36)					
Total fabric heat loss						(33) + (36) =		67.0871 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.8582	Feb 41.6126	Mar 41.3718	Apr 40.2410	May 40.0294	Jun 39.0446	Jul 39.0446	Aug 38.8622	Sep 39.4239	Oct 40.0294	Nov 40.4574	Dec 40.9049	(38)
Heat transfer coeff	108.9453	108.6997	108.4590	107.3282	107.1166	106.1317	106.1317	105.9493	106.5111	107.1166	107.5446	107.9920	(39)
Average = Sum(39)m / 12 =												107.3271	(39)
HLP	Jan 1.2319	Feb 1.2291	Mar 1.2264	Apr 1.2136	May 1.2112	Jun 1.2000	Jul 1.2000	Aug 1.1980	Sep 1.2043	Oct 1.2112	Nov 1.2160	Dec 1.2211	(40)
HLP (average)												1.2136	(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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
Daily hot water use	Jan 105.6432	Feb 101.8017	Mar 97.9601	Apr 94.1185	May 90.2769	Jun 86.4354	Jul 86.4354	Aug 90.2769	Sep 94.1185	Oct 97.9601	Nov 101.8017	Dec 105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)												Total = Sum(45)m = 1511.0721 (45)
Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Target Emissions 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.9194	46.4146	46.0041	42.6257	44.0465	46.0041	46.4146	49.9194	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	207.6248	183.0484	191.3127	169.6848	164.2848	144.6929	138.6268	154.5364	156.2431	177.9139	189.0311	202.6814	202.6814	202.6814	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	207.6248	183.0484	191.3127	169.6848	164.2848	144.6929	138.6268	154.5364	156.2431	177.9139	189.0311	202.6814	202.6814	202.6814	(64)
Heat gains from water heating, kWh/month	64.8311	57.0663	59.4931	52.5910	50.8293	44.5938	42.4596	47.5880	48.1216	55.0380	58.7843	63.1875	63.1875	63.1875	(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	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9007	19.4520	15.8194	11.9763	8.9525	7.5580	8.1667	10.6154	14.2480	18.0911	21.1150	22.5094	22.5094	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.1783	238.6291	232.4532	219.3054	202.7086	187.1101	176.6892	174.2385	180.4144	193.5622	210.1589	225.7575	225.7575	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	(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	3.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)	
Water heating gains (Table 5)	87.1386	84.9201	79.9639	73.0430	68.3190	61.9358	57.0693	63.9624	66.8356	73.9758	81.6449	84.9294	84.9294	(72)	
Total internal gains	410.2740	408.0576	393.2929	369.3811	345.0365	321.6603	306.9817	313.8726	326.5543	350.6855	377.9752	398.2527	398.2527	(73)	

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g		FF		Access factor Table 6d		Gains W
							Specific data or Table 6b		Specific data or Table 6c				
North				5.2200	10.6334		0.6300		0.7000		0.7700		16.9634 (74)
East				0.8300	19.6403		0.6300		0.7000		0.7700		4.9819 (76)
South				7.7200	46.7521		0.6300		0.7000		0.7700		110.3037 (78)
West				0.6000	19.6403		0.6300		0.7000		0.7700		3.6014 (80)
Solar gains	135.8504	229.8578	312.8529	388.8909	439.6375	439.0144	422.1358	383.3726	338.7739	253.3600	162.3764		116.5126 (83)
Total gains	546.1244	637.9154	706.1458	758.2721	784.6741	760.6747	729.1175	697.2452	665.3282	604.0455	540.3516		514.7652 (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	56.3738	56.5012	56.6266	57.2233	57.3363	57.8684	57.8684	57.9680	57.6622	57.3363	57.1081	56.8715	56.8715			
alpha	4.7583	4.7667	4.7751	4.8149	4.8224	4.8579	4.8579	4.8645	4.8441	4.8224	4.8072	4.7914	4.7914			
util living area	0.9977	0.9948	0.9878	0.9674	0.9105	0.7792	0.6119	0.6570	0.8674	0.9754	0.9952	0.9983	0.9983	(86)		
MIT	19.6665	19.8323	20.0835	20.4067	20.7042	20.9089	20.9781	20.9692	20.8340	20.4488	19.9957	19.6367	19.6367	(87)		
Th 2	19.8946	19.8968	19.8990	19.9092	19.9111	19.9200	19.9200	19.9216	19.9165	19.9111	19.9072	19.9032	19.9032	(88)		
util rest of house	0.9969	0.9930	0.9834	0.9542	0.8719	0.6878	0.4759	0.5229	0.7980	0.9629	0.9932	0.9977	0.9977	(89)		
MIT 2	18.1253	18.3686	18.7349	19.2049	19.6105	19.8561	19.9116	19.9085	19.7801	19.2716	18.6152	18.0879	18.0879	(90)		
Living area fraction	18.3641	18.5954	18.9438	19.3911	19.7799	20.0192	20.0768	20.0728	19.9434	19.4539	18.8291	18.3278	18.3278	(91)		
MIT	18.3641	18.5954	18.9438	19.3911	19.7799	20.0192	20.0768	20.0728	19.9434	19.4539	18.8291	18.3278	18.3278	(92)		
Temperature adjustment														0.0000		
adjusted MIT	18.3641	18.5954	18.9438	19.3911	19.7799	20.0192	20.0768	20.0728	19.9434	19.4539	18.8291	18.3278	18.3278	(93)		

8. Space heating requirement

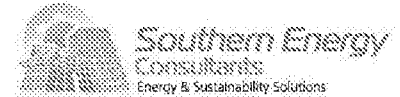
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9899	0.9778	0.9459	0.8662	0.6972	0.4968	0.5432	0.8001	0.9556	0.9902	0.9964	(94)
Useful gains	543.5231	631.4483	690.5036	717.2539	679.6651	530.3732	362.2121	378.7154	532.3348	577.2004	535.0664	512.8911	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1532.2137	1488.6824	1349.6428	1125.9867	865.4921	575.1484	369.0039	389.1321	622.3858	948.4021	1261.3982	1525.6930	(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	735.5859	576.0613	490.3995	294.2876	138.2552	0.0000	0.0000	0.0000	0.0000	276.1741	522.9589	753.5246	(98)
Space heating												3787.2472	(98)
Space heating per m2												(98) / (4) =	42.8228 (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

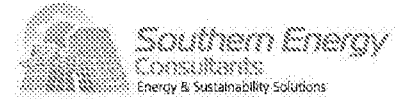
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4054.8685 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	735.5859	576.0613	490.3995	294.2876	138.2552	0.0000	0.0000	0.0000	0.0000	276.1741	522.9589	753.5246 (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)	787.5652	616.7680	525.0530	315.0831	148.0249	0.0000	0.0000	0.0000	0.0000	295.6896	559.9132	806.7715 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	207.6248	183.0484	191.3127	169.6848	164.2848	144.6929	138.6268	154.5364	156.2431	177.9139	189.0311	202.6814 (64)
Efficiency of water heater	87.9645	87.7389	87.3179	86.4245	84.6204	80.3000	80.3000	80.3000	80.3000	86.1543	87.4788	80.3000 (216)
Fuel for water heating, kWh/month	236.0324	208.6285	219.0992	196.3388	194.1432	180.1904	172.6361	192.4488	194.5742	206.5061	216.0879	230.1825 (219)
Water heating fuel used												2446.8680 (219)
Annual totals kWh/year												
Space heating fuel - main system												4054.8685 (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)												386.7735 (232)
Total delivered energy for all uses												6963.5100 (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	4054.8685	0.2160	875.8516 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2446.8680	0.2160	528.5235 (264)
Space and water heating			1404.3751 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7735	0.5190	200.7355 (268)
Total CO2, kg/m2/year			1644.0355 (272)
Emissions per m2 for space and water heating			15.8794 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2697 (272b)
Emissions per m2 for pumps and fans			0.4401 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8794 * 1.00) + 2.2697 + 0.4401, rounded to 2 d.p.			18.5900 (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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1393 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3893 (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)	=	0.3309 (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	0.4219	0.4136	0.4054	0.3640	0.3557	0.3144	0.3144	0.3061	0.3309	0.3557	0.3723	0.3888 (22b)
Effective ac	0.5890	0.5855	0.5822	0.5662	0.5633	0.5494	0.5494	0.5468	0.5548	0.5633	0.5693	0.5756 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			9.0000	397.9800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17300.2200 (34)
195.6153 (35)
8.5520 (36)
(33) + (36) = 75.7678 (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	41.8582	41.6126	41.3718	40.2410	40.0294	39.0446	39.0446	38.8622	39.4239	40.0294	40.4574	40.9049 (38)
Heat transfer coeff	117.6260	117.3804	117.1396	116.0088	115.7972	114.8123	114.8123	114.6299	115.1917	115.7972	116.2252	116.6727 (39)
Average = Sum(39)m / 12 =												116.0078 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3300	1.3272	1.3245	1.3117	1.3093	1.2982	1.2982	1.2961	1.3025	1.3093	1.3142	1.3192 (40)
HLP (average)												1.3117 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)										Total = Sum(45)m =		1511.0721 (45)

Regs Region: England

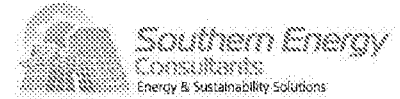
Elmhurst Energy Systems

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

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	33.2915	29.1170	30.0461	26.1949	25.1346	21.6893	20.0983	23.0631	23.3385	27.1988	29.6896	32.2410 (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	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9007	19.4520	15.8194	11.9763	8.9525	7.5580	8.1667	10.6154	14.2480	18.0911	21.1150	22.5094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.1783	236.6291	232.4532	219.3054	202.7066	187.1101	176.6892	174.2385	180.4144	193.5622	210.1589	225.7575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	(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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)
Water heating gains (Table 5)	44.7466	43.3288	40.3845	36.3818	33.7831	30.1240	27.0139	30.9988	32.4146	36.5576	41.2356	43.3347	(72)
Total internal gains	364.8820	363.4663	350.7135	329.7199	307.5006	286.8485	273.9262	277.9091	289.1334	310.2672	334.5659	353.6580	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	5.2200	10.6334	0.4400		0.0000		0.7700	18.8055 (74)
East	0.8300	19.6403	0.4400		0.0000		0.7700	5.5229 (76)
South	7.7200	46.7521	0.4400		0.0000		0.7700	122.2817 (78)
West	0.6000	19.6403	0.4400		0.0000		0.7700	3.9925 (80)

Solar gains	150.6026	254.8184	346.8261	431.1212	487.3785	486.6877	467.9762	425.0036	375.5619	280.8727	180.0092	129.1649	(83)
Total gains	515.4847	618.2847	697.5396	760.8411	794.8791	773.5362	741.9025	702.9127	664.6953	591.1400	514.5751	462.8229	(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	40.8551	40.9406	41.0247	41.4246	41.5003	41.8563	41.8563	41.9229	41.7184	41.5003	41.3474	41.1889	
alpha	3.7237	3.7294	3.7350	3.7616	3.7667	3.7904	3.7904	3.7949	3.7812	3.7667	3.7565	3.7459	
util living area	0.9949	0.9895	0.9785	0.9516	0.8909	0.7705	0.6207	0.6660	0.8551	0.9639	0.9907	0.9960	(86)
MIT	19.2094	19.4225	19.7452	20.1583	20.5431	20.8276	20.9446	20.9265	20.7190	20.2138	19.6313	19.1711	(87)
Th 2	19.8174	19.8196	19.8217	19.8317	19.8335	19.8422	19.8422	19.8439	19.8389	19.8335	19.8297	19.8258	(88)
util rest of house	0.9935	0.9866	0.9721	0.9358	0.8515	0.6827	0.4827	0.5322	0.7887	0.9490	0.9876	0.9949	(89)
MIT 2	18.1975	18.4108	18.7318	19.1429	19.5052	19.7506	19.8247	19.8182	19.6691	19.2038	18.6275	18.1656	(90)
Living area fraction									fLA = Living area / (4) =			0.1549	(91)
MIT	18.3543	18.5675	18.8888	19.3002	19.6660	19.9175	19.9982	19.9899	19.8317	19.3603	18.7830	18.3213	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3543	18.5675	18.8888	19.3002	19.6660	19.9175	19.9982	19.9899	19.8317	19.3603	18.7830	18.3213	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	510.8379	607.3131	673.3052	705.0195	671.3734	533.1504	373.1871	387.2806	523.9035	556.2142	506.1440	479.3741	(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	1653.1474	1604.3013	1451.2173	1206.5151	922.4350	610.5090	390.1556	411.5048	660.2480	1014.4161	1357.8559	1647.5755	(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	849.8783	669.9761	578.7665	361.0768	186.7899	0.0000	0.0000	0.0000	0.0000	340.9022	613.2325	869.1419	(98)
Space heating												4469.7643	(98)
Space heating per m2										(98) / (4) =		50.5401	(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	1079.2360	849.6113	871.1876	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

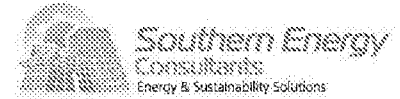


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7611	0.8379	0.8123	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	821.4056	711.8560	707.6730	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.4451	963.4327	919.6538	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	130.3484	187.1731	157.7137	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												475.2352 (104)
Intermittency factor (Table 10b)									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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	32.5871	46.7933	39.4284	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												118.8088 (107)
Space cooling per m2												1.3434 (108)
Energy for space heating												50.5401 (99)
Energy for space cooling												1.3434 (108)
Total												51.8835 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.9 (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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1393 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3893 (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) =	0.3309 (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	0.4219	0.4136	0.4054	0.3640	0.3557	0.3144	0.3144	0.3061	0.3309	0.3557	0.3723	0.3888 (22b)
Effective ac	0.5890	0.5855	0.5822	0.5662	0.5633	0.5494	0.5494	0.5468	0.5548	0.5633	0.5693	0.5756 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)					
TER Opening Type (Uw = 1.40)			14.3700	1.3258	19.0511		(27)					
Heat Loss Floor 1			44.2200	0.1300	5.7486		(28a)					
Brick Cavity	135.8700	18.6700	117.2000	0.1800	21.0960		(29a)					
Main Plane	44.2200		44.2200	0.1300	5.7486		(30)					
Total net area of external elements Aum(A, m2)			224.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3743		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7128 (36)					
Total fabric heat loss						(33) + (36) =	67.0871 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.8582	Feb 41.6126	Mar 41.3718	Apr 40.2410	May 40.0294	Jun 39.0446	Jul 39.0446	Aug 38.8622	Sep 39.4239	Oct 40.0294	Nov 40.4574	Dec 40.9049 (38)
Heat transfer coeff	108.9453	108.6997	108.4590	107.3282	107.1166	106.1317	106.1317	105.9493	106.5111	107.1166	107.5446	107.9920 (39)
Average = Sum(39)m / 12 =												107.3271 (39)
HLP	Jan 1.2319	Feb 1.2291	Mar 1.2264	Apr 1.2136	May 1.2112	Jun 1.2000	Jul 1.2000	Aug 1.1980	Sep 1.2043	Oct 1.2112	Nov 1.2160	Dec 1.2211 (40)
HLP (average)												1.2136 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
Daily hot water use	Jan 105.6432	Feb 101.8017	Mar 97.9601	Apr 94.1185	May 90.2769	Jun 86.4354	Jul 86.4354	Aug 90.2769	Sep 94.1185	Oct 97.9601	Nov 101.8017	Dec 105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)												Total = Sum(45)m = 1511.0721 (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)

Regs Region: England

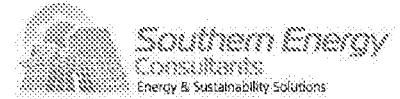
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	33.2915	29.1170	30.0461	26.1949	25.1346	21.6893	20.0983	23.0631	23.3385	27.1988	29.6896	32.2410 (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	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	130.1880	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9007	19.4520	15.8194	11.9763	8.9525	7.5580	8.1667	10.6154	14.2480	18.0911	21.1150	22.5094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.1783	238.6291	232.4532	219.3054	202.7086	187.1101	176.6892	174.2385	180.4144	193.5622	210.1589	225.7575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	36.0188	(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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)
Water heating gains (Table 5)	44.7466	43.3288	40.3845	36.3818	33.7831	30.1240	27.0139	30.9988	32.4146	36.5576	41.2356	43.3347	(72)
Total internal gains	364.8820	363.4663	350.7135	329.7199	307.5006	286.8485	273.9262	277.9091	289.1334	310.2672	334.5659	353.6580	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.2200	10.6334	0.6300	0.7000	0.7700	16.9634 (74)
East	0.8300	19.6403	0.6300	0.7000	0.7700	4.9819 (76)
South	7.7200	46.7521	0.6300	0.7000	0.7700	110.3037 (78)
West	0.6000	19.6403	0.6300	0.7000	0.7700	3.6014 (80)

Solar gains	135.8504	229.8578	312.8529	388.8909	439.6375	439.0144	422.1358	383.3726	338.7739	253.3600	162.3764	116.5126	(83)
Total gains	500.7325	593.3241	663.5665	718.6108	747.1382	725.8629	696.0621	661.2817	627.9073	563.6272	496.9423	470.1706	(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	56.3738	56.5012	56.6266	57.2233	57.3363	57.8684	57.8684	57.9680	57.6622	57.3363	57.1081	56.8715	
alpha	4.7583	4.7667	4.7751	4.8149	4.8224	4.8579	4.8579	4.8645	4.8441	4.8224	4.8072	4.7914	
util living area	0.9984	0.9962	0.9905	0.9733	0.9232	0.8006	0.6357	0.6843	0.8870	0.9812	0.9966	0.9989	(86)
MIT	19.6194	19.7867	20.0413	20.3709	20.6782	20.8968	20.9743	20.9633	20.8129	20.4108	19.9511	19.5904	(87)
Th 2	19.8946	19.8968	19.8990	19.9092	19.9111	19.9200	19.9200	19.9216	19.9165	19.9111	19.9072	19.9032	(88)
util rest of house	0.9979	0.9948	0.9870	0.9622	0.8882	0.7117	0.4969	0.5485	0.8233	0.9712	0.9952	0.9985	(89)
MIT 2	18.6398	18.8082	19.0629	19.3946	19.6843	19.8694	19.9131	19.9107	19.8087	19.4385	18.9809	18.6175	(90)
Living area fraction									fLA = Living area / (4) =			0.1549	(91)
MIT	18.7915	18.9598	19.2144	19.5458	19.8383	20.0286	20.0775	20.0737	19.9642	19.5891	19.1312	18.7682	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7915	18.9598	19.2144	19.5458	19.8383	20.0286	20.0775	20.0737	19.9642	19.5891	19.1312	18.7682	(93)

8. Space heating requirement

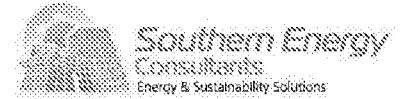
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	499.2821	589.3153	652.9411	687.9518	661.4920	523.9714	360.9238	376.5048	519.0883	545.1468	493.8543	469.1586	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1578.7843	1528.2951	1378.9944	1142.5974	871.7437	576.1417	369.0741	389.2279	624.6047	962.8849	1293.8910	1573.2509	(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	803.1496	630.9944	540.1836	327.3448	156.4273	0.0000	0.0000	0.0000	0.0000	310.7972	576.0264	821.4446	(98)
Space heating												4166.3680	(98)
Space heating per m ²										(98) / (4) =		47.1095	(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	997.6379	785.3745	805.2147	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8069	0.8841	0.8603	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	804.9577	694.3470	692.7516	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	946.7231	909.8530	870.9941	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)

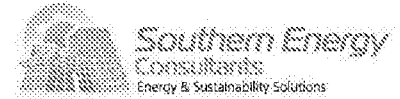


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	102.0711	160.3365	132.6124	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												395.0201 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	25.5178	40.0841	33.1531	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.7550 (107)
Space cooling per m2												1.1166 (108)
Energy for space heating												47.1095 (99)
Energy for space cooling												1.1166 (108)
Total												48.2262 (109)
Target Fabric Energy Efficiency (TFEE)												55.5 (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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (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) = 0.1857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4357 (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) =	0.3704 (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	0.3889	0.3704	0.3704	0.3426	0.3426	0.3056	0.3148	0.2963	0.3056	0.3241	0.3241	0.3519 (22b)
Effective ac	0.5756	0.5686	0.5686	0.5587	0.5587	0.5467	0.5496	0.5439	0.5467	0.5525	0.5525	0.5619 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17698.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 200.1153 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5520 (36)
Total fabric heat loss (33) + (36) = 75.7678 (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	40.9071	40.4075	40.4075	39.7037	39.7037	38.8507	39.0548	38.6527	38.8507	39.2650	39.2650	39.9322 (38)
Heat transfer coeff	116.6749	116.1753	116.1753	115.4715	115.4715	114.6185	114.8226	114.4204	114.6185	115.0328	115.0328	115.7000 (39)
Average = Sum(39)m / 12 =												115.3512 (39)
HLP	1.3193	1.3136	1.3136	1.3056	1.3056	1.2960	1.2983	1.2938	1.2960	1.3007	1.3007	1.3082 (40)
HLP (average)												1.3043 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)										Total = Sum(45)m =		1511.0721 (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

Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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	14.1326	12.7541	14.0890	13.5912	14.0128	13.5245	13.9528	13.9917	13.5609	14.0575	13.6481	14.1207 (61)
Total heat required for water heating calculated for each month	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	55.6245	48.7480	50.5355	44.3851	42.8315	37.3185	34.9361	39.5849	39.9082	46.0725	49.8676	53.9779 (65)
												1677 (64)
												1676.5080 (64)
												1677 (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	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7518	48.6301	39.5486	29.9409	22.3811	18.8951	20.4168	26.5386	35.6200	45.2278	52.7875	56.2735	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5049	356.1628	346.9450	327.3214	302.5502	279.2687	263.7153	260.0574	269.2752	288.8987	313.6700	336.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	(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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)
Water heating gains (Table 5)	74.7642	72.5417	67.9241	61.6460	57.5693	51.8312	46.9572	53.2055	55.4280	61.9254	69.2605	72.5510	(72)
Total internal gains	590.3224	585.6360	562.7193	527.2098	490.8021	458.2966	439.3908	448.1030	468.6247	504.3535	544.0195	574.0774	(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				5.2200	11.9814		0.4400		0.0000		0.7700		21.1896 (74)
East				0.8300	22.3313		0.4400		0.0000		0.7700		6.2797 (76)
South				7.7200	50.9848		0.4400		0.0000		0.7700		133.3526 (78)
West				0.6000	22.3313		0.4400		0.0000		0.7700		4.5395 (80)
Solar gains	165.3614	251.7987	339.4797	437.7554	485.2078	519.9819	493.9880	456.3831	399.3710	296.5219	202.4696	140.4776	(83)
Total gains	755.6838	837.4348	902.1990	964.9653	976.0099	978.2785	933.3788	904.4861	867.9958	800.8754	746.4891	714.5551	(84)

7. Mean internal temperature (heating season)

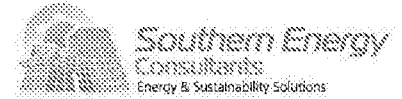
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.1356	42.3168	42.3168	42.5747	42.5747	42.8916	42.8153	42.9658	42.8916	42.7371	42.7371	42.4906	
alpha	3.8090	3.8211	3.8211	3.8383	3.8383	3.8594	3.8544	3.8644	3.8594	3.8491	3.8491	3.8327	
util living area	0.9804	0.9700	0.9460	0.8887	0.7710	0.5525	0.3756	0.3974	0.6777	0.8935	0.9642	0.9835 (86)	
MIT	19.6447	19.8105	20.1153	20.4826	20.7910	20.9602	20.9934	20.9918	20.9065	20.5534	20.0529	19.6141 (87)	
Th 2	19.8258	19.8302	19.8302	19.8364	19.8364	19.8440	19.8422	19.8457	19.8440	19.8403	19.8403	19.8344 (88)	
util rest of house	0.9750	0.9619	0.9306	0.8558	0.7021	0.4387	0.2382	0.2578	0.5736	0.8548	0.9528	0.9789 (89)	
MIT 2	18.0776	18.3183	18.7521	19.2620	19.6503	19.8236	19.8409	19.8440	19.7824	19.3694	18.6765	18.0395 (90)	
Living area fraction									fLA = Living area / (4) =			0.1549 (91)	
MIT	18.3204	18.5495	18.9633	19.4511	19.8270	19.9997	20.0195	20.0218	19.9565	19.5528	18.8897	18.2834 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1704	18.3995	18.8133	19.3011	19.6770	19.8497	19.8695	19.8718	19.8065	19.4028	18.7397	18.1334 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9640	0.9480	0.9130	0.8372	0.6913	0.4393	0.2415	0.2610	0.5699	0.8364	0.9377	0.9691 (94)
Useful gains	728.4695	793.9236	823.7317	807.9057	674.7232	429.7914	225.4120	236.0698	494.6512	669.8553	699.9536	692.4800 (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	1524.9825	1486.9814	1325.9401	1085.5554	771.0088	441.2424	226.1385	237.0611	527.9952	897.5801	1235.4188	1507.9638 (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	592.6057	465.7349	373.6431	199.9077	71.6365	0.0000	0.0000	0.0000	0.0000	169.4272	385.5350	606.7199 (98)
Space heating												2865.2100 (98)
RHI space heating demand												2865 (98)

FULL SAP CALCULATION PRINTOUT

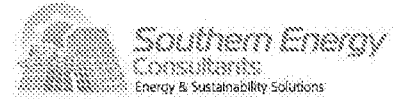
Calculation Type: New Build (As Designed)



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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (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) = 0.1857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4357 (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) =	0.3704 (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	0.4722	0.4630	0.4537	0.4074	0.3982	0.3519	0.3519	0.3426	0.3704	0.3982	0.4167	0.4352 (22b)
Effective ac	0.6115	0.6072	0.6029	0.5630	0.5793	0.5619	0.5619	0.5587	0.5686	0.5793	0.5868	0.5947 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17698.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.1153 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5520 (36)
Total fabric heat loss						(33) + (36) =	75.7678 (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	43.4571	43.1494	42.8478	41.4311	41.1661	39.9322	39.9322	39.7037	40.4075	41.1661	41.7023	42.2628 (38)
Heat transfer coeff	119.2249	118.9172	118.6156	117.1989	116.9339	115.7000	115.7000	115.4715	116.1753	116.9339	117.4701	118.0306 (39)
Average = Sum(39)m / 12 =												117.1976 (39)
HLP	1.3481	1.3446	1.3412	1.3252	1.3222	1.3082	1.3082	1.3056	1.3136	1.3222	1.3282	1.3346 (40)
HLP (average)												1.3252 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
Daily hot water use	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)										Total = Sum(45)m =		1511.0721 (45)

Regs Region: England

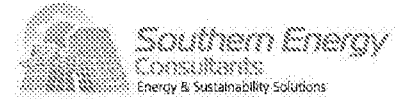
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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	14.1326	12.7541	14.0890	13.5912	14.0128	13.5245	13.9528	13.9917	13.5609	14.0575	13.6481	14.1207 (61)
Total heat required for water heating calculated for each month	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (64)
Heat gains from water heating, kWh/month	55.6245	48.7480	50.5355	44.3851	42.8315	37.3185	34.9361	39.5849	39.9082	46.0725	49.8676	53.9779 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1676.5080 (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	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7518	48.6301	39.5486	29.9409	22.3811	18.8951	20.4168	26.5386	35.6200	45.2278	52.7875	56.2735 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5049	356.1628	346.9450	327.3214	302.5502	279.2687	263.7153	260.0574	269.2752	288.8987	313.6700	336.9514 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263 (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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504 (71)
Water heating gains (Table 5)	74.7642	72.5417	67.9241	61.6460	57.5693	51.8312	46.9572	53.2055	55.4280	61.9254	69.2605	72.5510 (72)
Total internal gains	590.3224	585.6360	562.7193	527.2098	490.8021	458.2966	439.3908	448.1030	468.6247	504.3535	544.0195	574.0774 (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			5.2200		10.6334		0.4400		0.0000		0.7700		18.8055 (74)
East			0.8300		19.6403		0.4400		0.0000		0.7700		5.5229 (76)
South			7.7200		46.7521		0.4400		0.0000		0.7700		122.2817 (78)
West			0.6000		19.6403		0.4400		0.0000		0.7700		3.9925 (80)
Solar gains	150.6026	254.8184	346.8261	431.1212	487.3785	486.6877	467.9762	425.0036	375.5619	280.8727	180.0092	129.1649	(83)
Total gains	740.9250	840.4544	909.5454	958.3310	978.1806	944.9843	907.3670	873.1066	844.1866	785.2262	724.0287	703.2423	(84)

7. Mean internal temperature (heating season)

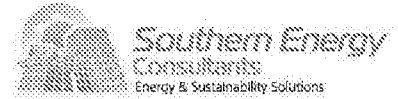
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.2344	41.3411	41.4462	41.9472	42.0423	42.4906	42.4906	42.5747	42.3168	42.0423	41.8504	41.6516
alpha	3.7490	3.7561	3.7631	3.7965	3.8028	3.8327	3.8327	3.8383	3.8211	3.8028	3.7900	3.7768
util living area	0.9844	0.9740	0.9550	0.9136	0.8315	0.6874	0.5324	0.5695	0.7716	0.9235	0.9739	0.9870 (86)
MIT	19.4746	19.6740	19.9693	20.3409	20.6668	20.8892	20.9683	20.9586	20.8170	20.4032	19.8738	19.4375 (87)
Th 2	19.8034	19.8061	19.8087	19.8212	19.8235	19.8344	19.8344	19.8364	19.8302	19.8235	19.8188	19.8138 (88)
util rest of house	0.9803	0.9672	0.9426	0.8884	0.7800	0.5935	0.4042	0.4422	0.6899	0.8960	0.9658	0.9836 (89)
MIT 2	17.8164	18.1054	18.5297	19.0586	19.4907	19.7545	19.8210	19.8172	19.6816	19.1559	18.4056	17.7696 (90)
Living area fraction	18.0733	18.3484	18.7527	19.2573	19.6729	19.9303	19.9988	19.9941	19.8575	19.3492	18.6330	18.0279 (92)
MIT	17.9233	18.1984	18.6027	19.1073	19.5229	19.7803	19.8488	19.8441	19.7075	19.1992	18.4830	17.8779 (93)
Temperature adjustment												-0.1500
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9706	0.9541	0.9258	0.8691	0.7645	0.5887	0.4059	0.4431	0.6800	0.8769	0.9527	0.9751 (94)
Ext temp.	719.1536	801.8940	842.0288	832.9121	747.7818	556.3082	368.2597	386.8640	574.0059	688.5862	689.7537	685.7079 (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	1624.2358	1581.4054	1435.5672	1196.2790	914.7642	599.3588	375.8813	397.6897	651.4555	1005.5319	1337.1650	1614.4159 (97)
Space heating kWh	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	673.3812	523.8317	441.5926	261.6242	124.2349	0.0000	0.0000	0.0000	0.0000	235.8076	466.1361	690.9588 (98)
Space heating per m2												3417.5670 (98)
(98) / (4) = 38.6428 (99)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3776.3172	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	673.3812	523.8317	441.5926	261.6242	124.2349	0.0000	0.0000	0.0000	0.0000	235.8076	466.1361	690.9588	(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)	744.0676	578.8195	487.9476	289.0875	137.2762	0.0000	0.0000	0.0000	0.0000	260.5609	515.0676	763.4904	(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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432	(64)	
Efficiency of water heater (217)m	89.8338	89.7684	89.6443	89.3748	88.8210	87.3000	87.3000	87.3000	87.3000	89.2699	89.6862	89.8624	(217)	
Fuel for water heating, kWh/month	190.1272	166.8462	173.4436	153.1319	148.9439	132.4075	124.3219	140.3482	141.3395	159.1265	171.0009	184.5523	(219)	
Water heating fuel used												1885.5895	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3776.3172	(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)													386.7735	(232)
Total delivered energy for all uses													6123.6802	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	3776.3172	3.4800	131.4158	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1885.5895	3.4800	65.6185	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	386.7735	13.1900	51.0154	(250)
Additional standing charges			120.0000	(251)
Total energy cost			377.9423	(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] =	1.1896	(257)
SAP value		83.4055	
SAP rating (Section 12)		83	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3776.3172	0.2160	815.6845	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1885.5895	0.2160	407.2873	(264)
Space and water heating			1222.9718	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	386.7735	0.5190	200.7355	(268)
Total kg/year			1462.6323	(272)
CO2 emissions per m2			16.5400	(273)
EI value			85.3123	
EI rating			85	(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	$3.48 / 0.8879 = 3.919$, stars = 4
Water heating environmental impact	$0.216 / 0.8879 = 0.2433$, stars = 4

Regs Region: England

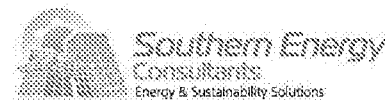
Elmhurst Energy Systems

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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (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) = 0.1857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4357 (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) =		0.3704 (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	0.3889	0.3704	0.3704	0.3426	0.3426	0.3056	0.3148	0.2963	0.3056	0.3241	0.3241	0.3519 (22b)
Effective ac	0.5756	0.5686	0.5686	0.5587	0.5587	0.5467	0.5496	0.5439	0.5467	0.5525	0.5525	0.5619 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17698.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 200.1153 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5520 (36)
Total fabric heat loss (33) + (36) = 75.7678 (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	40.9071	40.4075	40.4075	39.7037	39.7037	38.8507	39.0548	38.6527	38.8507	39.2650	39.2650	39.9322 (38)
Heat transfer coeff	116.6749	116.1753	116.1753	115.4715	115.4715	114.6185	114.8226	114.4204	114.6185	115.0328	115.0328	115.7000 (39)
Average = Sum(39)m / 12 =												115.3512 (39)
HLP	1.3193	1.3136	1.3136	1.3056	1.3056	1.2960	1.2983	1.2938	1.2960	1.3007	1.3007	1.3082 (40)
HLP (average)												1.3043 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)										Total = Sum(45)m =		1511.0721 (45)

Regs Region: England

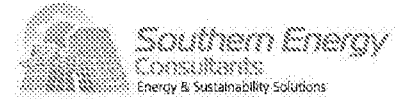
Elmhurst Energy Systems

SAP2012 Calculator (Design

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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	14.1326	12.7541	14.0890	13.5912	14.0128	13.5245	13.9528	13.9917	13.5609	14.0575	13.6481	14.1207 (61)
Total heat required for water heating calculated for each month	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (64)
Heat gains from water heating, kWh/month	55.6245	48.7480	50.5355	44.3851	42.8315	37.3185	34.9361	39.5849	39.9082	46.0725	49.8676	53.9779 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1676.5080 (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	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7518	48.6301	39.5486	29.9409	22.3811	18.8951	20.4168	26.5386	35.6200	45.2278	52.7875	56.2735	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5049	356.1628	346.9450	327.3214	302.5502	279.2687	263.7153	260.0574	269.2752	288.8987	313.6700	336.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	(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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)
Water heating gains (Table 5)	74.7642	72.5417	67.9241	61.6460	57.5693	51.8312	46.9572	53.2055	55.4280	61.9254	69.2605	72.5510	(72)
Total internal gains	590.3224	585.6360	562.7193	527.2098	490.8021	458.2966	439.3908	448.1030	468.6247	504.3535	544.0195	574.0774	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.2200	11.9814	0.4400	0.0000	0.7700	21.1896 (74)
East	0.8300	22.3313	0.4400	0.0000	0.7700	6.2797 (76)
South	7.7200	50.9848	0.4400	0.0000	0.7700	133.3526 (78)
West	0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (80)

Solar gains	165.3614	251.7987	339.4797	437.7554	485.2078	519.9819	493.9880	456.3831	399.3710	296.5219	202.4696	140.4776 (83)
Total gains	755.6838	837.4348	902.1990	964.9653	976.0099	978.2785	933.3788	904.4861	867.9958	800.8754	746.4891	714.5551 (84)

7. Mean internal temperature (heating season)

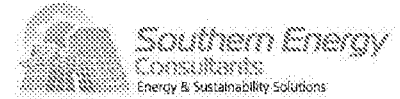
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.1356	42.3168	42.3168	42.5747	42.5747	42.8916	42.8153	42.9658	42.8916	42.7371	42.7371	42.4906	
alpha	3.8090	3.8211	3.8211	3.8383	3.8383	3.8594	3.8544	3.8644	3.8594	3.8491	3.8491	3.8327	
util living area	0.9804	0.9700	0.9460	0.8887	0.7710	0.5525	0.3756	0.3974	0.6777	0.8935	0.9642	0.9835	(86)
MIT	19.6447	19.8105	20.1153	20.4826	20.7910	20.9602	20.9934	20.9918	20.9065	20.5534	20.0529	19.6141	(87)
Th 2	19.8258	19.8302	19.8302	19.8364	19.8364	19.8440	19.8422	19.8457	19.8440	19.8403	19.8403	19.8344	(88)
util rest of house	0.9750	0.9619	0.9306	0.8558	0.7021	0.4387	0.2382	0.2578	0.5736	0.8548	0.9528	0.9789	(89)
MIT 2	18.0776	18.3183	18.7521	19.2620	19.6503	19.8236	19.8409	19.8440	19.7824	19.3694	18.6765	18.0395	(90)
Living area fraction	18.3204	18.5495	18.9633	19.4511	19.8270	19.9997	20.0195	20.0218	19.9565	19.5528	18.8897	18.2834	(91)
MIT	18.3204	18.5495	18.9633	19.4511	19.8270	19.9997	20.0195	20.0218	19.9565	19.5528	18.8897	18.2834	(92)
Temperature adjustment	18.1704	18.3995	18.8133	19.3011	19.6770	19.8497	19.8695	19.8718	19.8065	19.4028	18.7397	-0.1500	
adjusted MIT	18.1704	18.3995	18.8133	19.3011	19.6770	19.8497	19.8695	19.8718	19.8065	19.4028	18.7397	18.1334	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	728.4695	793.9236	823.7317	807.9057	674.7232	429.7914	225.4120	236.0698	494.6512	669.8553	699.9536	692.4800	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1524.9825	1486.9814	1325.9401	1085.5554	771.0088	441.2424	226.1385	237.0611	527.9952	897.5801	1235.4188	1507.9638	(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	592.6057	465.7349	373.6431	199.9077	71.6365	0.0000	0.0000	0.0000	0.0000	169.4272	385.5350	606.7199	(98)
Space heating												2865.2100	(98)
Space heating per m2												32.3972	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3165.9779 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	592.6057	465.7349	373.6431	199.9077	71.6365	0.0000	0.0000	0.0000	0.0000	169.4272	385.5350	606.7199	(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)	654.8129	514.6241	412.8653	220.8925	79.1563	0.0000	0.0000	0.0000	0.0000	187.2124	426.0055	670.4088	(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	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432	(64)
Efficiency of water heater (217)m	89.7638	89.6999	89.5356	89.1717	88.3980	87.3000	87.3000	87.3000	87.3000	89.0120	89.5657	89.7934	(217)
Fuel for water heating, kWh/month	190.2753	166.9735	173.6542	153.4808	149.6567	132.4075	124.3219	140.3482	141.3395	159.5874	171.2309	184.6941	(219)
Water heating fuel used												1887.9699	(219)
Annual totals kWh/year													
Space heating fuel - main system												3165.9779	(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)												386.7735	(232)
Total delivered energy for all uses												5515.7213	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3165.9779	3.8700	122.5233 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1887.9699	3.8700	73.0644 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	386.7735	18.9000	73.1002 (250)
Additional standing charges			93.0000 (251)
Total energy cost			375.8630 (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	3165.9779	0.2160	683.8512 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1887.9699	0.2160	407.8015 (264)
Space and water heating			1091.6527 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7735	0.5190	200.7355 (268)
Total kg/year			1331.3132 (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	3165.9779	1.2200	3862.4930 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1887.9699	1.2200	2303.3232 (264)
Space and water heating			6165.8163 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	386.7735	3.0700	1187.3948 (268)
Primary energy kWh/year			7583.4610 (272)
Primary energy kWh/m2/year			85.7470 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 85

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 28	-186 kg (13.9%)
U Solar photovoltaic panels	+ 10.0	-£ 345	-947 kg (82.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28	2.10 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	10.70 kg/m²	A 95 A 96
Total Savings	£373	12.80 kg/m²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 96

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)

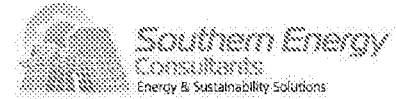
Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£87	£97	-£9
Mains gas	£289	£251	£38
Space heating	£230	£230	£0
Water heating	£73	£45	£28
Lighting	£73	£73	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£376	£3	£374
Total cost of uses	£376	£3	£373
Delivered energy	62 kWh/m²	31 kWh/m²	31 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	2 kg/m²	13 kg/m²
Primary energy	86 kWh/m²	11 kWh/m²	75 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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (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) = 0.1857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4357 (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) =	0.3704 (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	0.4722	0.4630	0.4537	0.4074	0.3982	0.3519	0.3519	0.3426	0.3704	0.3982	0.4167	0.4352 (22b)
Effective ac	0.6115	0.6072	0.6029	0.5630	0.5793	0.5619	0.5619	0.5587	0.5686	0.5793	0.5868	0.5947 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	17698.2000 (34)
	200.1153 (35)
	8.5520 (36)
(33) + (36) =	75.7678 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 43.4571 Feb 43.1494 Mar 42.8478 Apr 41.4311 May 41.1661 Jun 39.9322 Jul 39.9322 Aug 39.7037 Sep 40.4075 Oct 41.1661 Nov 41.7023 Dec 42.2628 (38)
Heat transfer coeff	119.2249 118.9172 118.6156 117.1989 116.9339 115.7000 115.7000 115.4715 116.1753 116.9339 117.4701 118.0306 (39)
Average = Sum(39)m / 12 =	117.1976 (39)
HLP	Jan 1.3481 Feb 1.3446 Mar 1.3412 Apr 1.3252 May 1.3222 Jun 1.3082 Jul 1.3082 Aug 1.3056 Sep 1.3136 Oct 1.3222 Nov 1.3282 Dec 1.3346 (40)
HLP (average)	1.3252 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)										Total = Sum(45)m =		1511.0721 (45)

Regs Region: England

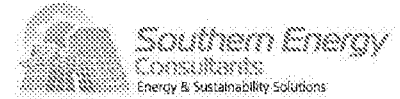
Elmhurst Energy Systems

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

Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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	14.1326	12.7541	14.0890	13.5912	14.0128	13.5245	13.9528	13.9917	13.5609	14.0575	13.6481	14.1207 (61)
Total heat required for water heating calculated for each month	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2002 (H8)
Utilisation factor												0.5653 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.0393 (H14)
Volume ratio Veff/V												0.7809 (H15)
Solar storage volume factor												0.9505 (H16)
Solar input	-24.8500	-41.4675	-70.6238	-94.6498	-116.9319	-114.9627	-113.4434	-99.1161	-77.6278	-53.0106	-29.4756	-856.9545 (H17)
Solar input (sum of months) = Sum(63)m =												-856.9545 (63)
Output from w/h	145.9484	108.3076	84.8585	42.2115	15.3616	0.6290	0.0000	23.4079	45.7616	89.0413	123.8885	145.0480 (64)
Total per year (kWh/year) = Sum(64)m =												824.4640 (64)
Heat gains from water heating, kWh/month	55.6245	48.7480	50.5355	44.3851	42.8315	37.3185	34.9361	39.5849	39.9082	46.0725	49.8676	53.9779 (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	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7518	48.6301	39.5486	29.9409	22.3811	18.8951	20.4168	26.5386	35.6200	45.2278	52.7875	56.2735	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5049	356.1628	346.9450	327.3214	302.5502	279.2687	263.7153	260.0574	269.2752	288.8987	313.6700	336.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	(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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)
Water heating gains (Table 5)	74.7642	72.5417	67.9241	61.6460	57.5693	51.8312	46.9572	53.2055	55.4280	61.9254	69.2605	72.5510	(72)
Total internal gains	590.3224	585.6360	562.7193	527.2098	490.8021	458.2966	439.3908	448.1030	468.6247	504.3535	544.0195	574.0774	(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	5.2200	10.6334	0.4400	0.0000	0.7700	18.8055 (74)
East	0.8300	19.6403	0.4400	0.0000	0.7700	5.5229 (76)
South	7.7200	46.7521	0.4400	0.0000	0.7700	122.2817 (78)
West	0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)

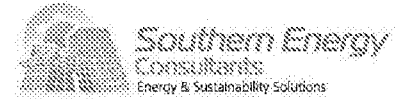
Solar gains	150.6026	254.8184	346.8261	431.1212	487.3785	486.6877	467.9762	425.0036	375.5619	280.8727	180.0092	129.1649 (83)
Total gains	740.9250	840.4544	909.5454	958.3310	978.1806	944.9843	907.3670	873.1066	844.1866	785.2262	724.0287	703.2423 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	41.2344	41.3411	41.4462	41.9472	42.0423	42.4906	42.4906	42.5747	42.3168	42.0423	41.8504	41.6516
alpha	3.7490	3.7561	3.7631	3.7965	3.8028	3.8327	3.8327	3.8383	3.8211	3.8028	3.7900	3.7768
util living area	0.9844	0.9740	0.9550	0.9136	0.8315	0.6874	0.5324	0.5695	0.7716	0.9235	0.9739	0.9870 (86)
MIT	19.4746	19.6740	19.9693	20.3409	20.6668	20.8892	20.9683	20.9586	20.8170	20.4032	19.8738	19.4375 (87)
Th 2	19.8034	19.8061	19.8087	19.8212	19.8235	19.8344	19.8344	19.8364	19.8302	19.8235	19.8188	19.8138 (88)
util rest of house	0.9803	0.9672	0.9426	0.8884	0.7800	0.5935	0.4042	0.4422	0.6899	0.8960	0.9658	0.9836 (89)
MIT 2	17.8164	18.1054	18.5297	19.0586	19.4907	19.7545	19.8210	19.8172	19.6816	19.1559	18.4056	17.7696 (90)
Living area fraction									fLA = Living area / (4) =			0.1549 (91)
MIT	18.0733	18.3484	18.7527	19.2573	19.6729	19.9303	19.9988	19.9941	19.8575	19.3492	18.6330	18.0279 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9233	18.1984	18.6027	19.1073	19.5229	19.7803	19.8488	19.8441	19.7075	19.1992	18.4830	17.8779 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9706	0.9541	0.9258	0.8691	0.7645	0.5887	0.4059	0.4431	0.6800	0.8769	0.9527	0.9751	(94)
Useful gains	719.1536	801.8940	842.0288	832.9121	747.7818	556.3082	368.2597	386.8640	574.0059	688.5862	689.7537	685.7079	(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	1624.2358	1581.4054	1435.5672	1196.2790	914.7642	599.3588	375.8813	397.6897	651.4555	1005.5319	1337.1650	1614.4159	(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	673.3812	523.8317	441.5926	261.6242	124.2349	0.0000	0.0000	0.0000	0.0000	235.8076	466.1361	690.9588	(98)
Space heating												3417.5670	(98)
Space heating per m2											(98) / (4) =	38.6428	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3776.3172	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	673.3812	523.8317	441.5926	261.6242	124.2349	0.0000	0.0000	0.0000	0.0000	235.8076	466.1361	690.9588	(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)	744.0676	578.8195	487.9476	289.0875	137.2762	0.0000	0.0000	0.0000	0.0000	260.5609	515.0676	763.4904	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	145.9484	108.3076	84.8585	42.2115	15.3616	0.6290	0.0000	23.4079	45.7616	89.0413	123.8885	145.0480	(64)	
Efficiency of water heater	89.9129	89.9352	89.9684	90.0415	90.1364	87.3000	87.3000	87.3000	87.3000	89.5998	89.6088	89.9281	(217)	
Fuel for water heating, kWh/month	162.3220	120.4285	94.3203	46.8801	17.0426	0.7205	0.0000	26.8131	52.4188	99.3767	137.9469	161.2934	(219)	
Water heating fuel used												919.5630	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3776.3172	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													386.7735	(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													3480.4143	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3776.3172	3.4800	131.4158	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	919.5630	3.4800	32.0008	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	386.7735	13.1900	51.0154	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			123.0967	(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] =	0.3874	(257)
SAP value		94.5951	
SAP rating (Section 12)		95	(258)
SAP band		A	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3776.3172	0.2160	815.6845 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.5630	0.2160	198.6256 (264)
Space and water heating			1014.3101 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	386.7735	0.5190	200.7355 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			383.4833 (272)
CO2 emissions per m2			4.3400 (273)
EI value			96.1491
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	44.2200 (1c)	x 2.5300 (2c)	= 111.8766 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.3514 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4357 (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) =		0.3704 (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	0.3889	0.3704	0.3704	0.3426	0.3426	0.3056	0.3148	0.2963	0.3056	0.3241	0.3241	0.3519 (22b)
Effective ac	0.5756	0.5686	0.5686	0.5587	0.5587	0.5467	0.5496	0.5439	0.5467	0.5525	0.5525	0.5619 (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)			14.3700	1.2357	17.7576		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick Cavity	135.8700	18.6700	117.2000	0.2500	29.3000	60.0000	7032.0000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Total net area of external elements Aum (A, m ²)			224.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.2158		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17698.2000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 200.1153 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5520 (36)
 Total fabric heat loss (33) + (36) = 75.7678 (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	40.9071	40.4075	40.4075	39.7037	39.7037	38.8507	39.0548	38.6527	38.8507	39.2650	39.2650	39.9322 (38)
Heat transfer coeff	116.6749	116.1753	116.1753	115.4715	115.4715	114.6185	114.8226	114.4204	114.6185	115.0328	115.0328	115.7000 (39)
Average = Sum(39)m / 12 =												115.3512 (39)
HLP	1.3193	1.3136	1.3136	1.3056	1.3056	1.2960	1.2983	1.2938	1.2960	1.3007	1.3007	1.3082 (40)
HLP (average)												1.3043 (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												2.6038 (42)
Average daily hot water use (litres/day)												96.0393 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.6432	101.8017	97.9601	94.1185	90.2769	86.4354	86.4354	90.2769	94.1185	97.9601	101.8017	105.6432 (44)
Energy conte	156.6659	137.0210	141.3934	123.2702	118.2806	102.0672	94.5803	108.5322	109.8285	127.9945	139.7160	151.7225 (45)
Energy content (annual)	Total = Sum(45)m =											1511.0721 (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

Distribution loss (46)m = 0.15 x (45)m	23.4999	20.5531	21.2090	18.4905	17.7421	15.3101	14.1870	16.2798	16.4743	19.1992	20.9574	22.7584 (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	14.1326	12.7541	14.0890	13.5912	14.0128	13.5245	13.9528	13.9917	13.5609	14.0575	13.6481	14.1207 (61)
Total heat required for water heating calculated for each month	170.7984	149.7751	155.4823	136.8614	132.2935	115.5917	108.5330	122.5240	123.3893	142.0520	153.3641	165.8432 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2676 (H8)
Utilisation factor												0.5457 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.0393 (H14)
Volume ratio Veff/V												0.7809 (H15)
Solar storage volume factor												0.9505 (H16)
Solar input	-26.8873	-40.4115	-68.0581	-94.0771	-113.3005	-119.2439	-116.3806	-103.9286	-81.1166	-55.1821	-32.6822	-873.5447 (H17)
Solar input (sum of months) = Sum(63)m =												-873.5447 (63)
Output from w/h	143.9111	109.3636	87.4242	42.7843	18.9930	0.0000	0.0000	18.5954	42.2727	86.8698	120.6819	143.5669 (64)
Total per year (kWh/year) = Sum(64)m =												814.4630 (64)
Heat gains from water heating, kWh/month	55.6245	48.7480	50.5355	44.3851	42.8315	37.3185	34.9361	39.5849	39.9082	46.0725	49.8676	53.9779 (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	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	156.2256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7518	48.6301	39.5486	29.9409	22.3811	18.8951	20.4168	26.5386	35.6200	45.2278	52.7875	56.2735	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5049	356.1628	346.9450	327.3214	302.5502	279.2687	263.7153	260.0574	269.2752	288.8987	313.6700	336.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	53.2263	(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)	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	-104.1504	(71)
Water heating gains (Table 5)	74.7642	72.5417	67.9241	61.6460	57.5693	51.8312	46.9572	53.2055	55.4280	61.9254	69.2605	72.5510	(72)
Total internal gains	590.3224	585.6360	562.7193	527.2098	490.8021	458.2966	439.3908	448.1030	468.6247	504.3535	544.0195	574.0774	(73)

6. Solar gains

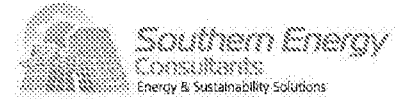
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				5.2200	11.9814	0.4400		0.0000		0.7700	21.1896 (74)	
East				0.8300	22.3313	0.4400		0.0000		0.7700	6.2797 (76)	
South				7.7200	50.9848	0.4400		0.0000		0.7700	133.3526 (78)	
West				0.6000	22.3313	0.4400		0.0000		0.7700	4.5395 (80)	
Solar gains	165.3614	251.7987	339.4797	437.7554	485.2078	519.9819	493.9880	456.3831	399.3710	296.5219	202.4696	140.4776 (83)
Total gains	755.6838	837.4348	902.1990	964.9653	976.0099	978.2785	933.3788	904.4861	867.9958	800.8754	746.4891	714.5551 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	42.1356	42.3168	42.3168	42.5747	42.5747	42.8916	42.8153	42.9658	42.8916	42.7371	42.7371	42.4906	
util living area	3.8090	3.8211	3.8211	3.8383	3.8383	3.8594	3.8544	3.8644	3.8594	3.8491	3.8491	3.8327	
	0.9804	0.9700	0.9460	0.8887	0.7710	0.5525	0.3756	0.3974	0.6777	0.8935	0.9642	0.9835 (86)	
MIT	19.6447	19.8105	20.1153	20.4826	20.7910	20.9602	20.9934	20.9918	20.9065	20.5534	20.0529	19.6141 (87)	
Th 2	19.8258	19.8302	19.8302	19.8364	19.8364	19.8440	19.8422	19.8457	19.8440	19.8403	19.8403	19.8344 (88)	
util rest of house	0.9750	0.9619	0.9306	0.8558	0.7021	0.4387	0.2382	0.2578	0.5736	0.8548	0.9528	0.9789 (89)	
MIT 2	18.0776	18.3183	18.7521	19.2620	19.6503	19.8236	19.8409	19.8440	19.7824	19.3694	18.6765	18.0395 (90)	
Living area fraction									fLA = Living area / (4) =			0.1549 (91)	
MIT	18.3204	18.5495	18.9633	19.4511	19.8270	19.9997	20.0195	20.0218	19.9565	19.5528	18.8897	18.2834 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1704	18.3995	18.8133	19.3011	19.6770	19.8497	19.8695	19.8718	19.8065	19.4028	18.7397	18.1334 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9640	0.9480	0.9130	0.8372	0.6913	0.4393	0.2415	0.2610	0.5699	0.8364	0.9377	0.9691	(94)
Useful gains	728.4695	793.9236	823.7317	807.9057	674.7232	429.7914	225.4120	236.0698	494.6512	669.8553	699.9536	692.4800	(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	1524.9825	1486.9814	1325.9401	1085.5554	771.0088	441.2424	226.1385	237.0611	527.9952	897.5801	1235.4188	1507.9638	(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	592.6057	465.7349	373.6431	199.9077	71.6365	0.0000	0.0000	0.0000	0.0000	169.4272	385.5350	606.7199	(98)
Space heating												2865.2100	(98)
Space heating per m2											(98) / (4) =	32.3972	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3165.9779	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	592.6057	465.7349	373.6431	199.9077	71.6365	0.0000	0.0000	0.0000	0.0000	169.4272	385.5350	606.7199	(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)	654.8129	514.6241	412.8653	220.8925	79.1563	0.0000	0.0000	0.0000	0.0000	187.2124	426.0055	670.4088	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	143.9111	109.3636	87.4242	42.7843	18.9930	0.0000	0.0000	18.5954	42.2727	86.8698	120.6819	143.5669	(64)	
Efficiency of water heater	89.8564	89.8735	89.8753	89.9189	89.8101	87.3000	87.3000	87.3000	87.3000	89.3894	89.7160	89.8697	(217)	
Fuel for water heating, kWh/month	160.1568	121.6861	97.2728	47.5809	21.1479	0.0000	0.0000	21.3006	48.4224	97.1813	134.5155	159.7502	(219)	
Water heating fuel used												909.0143	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3165.9779	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													386.7735	(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													2762.6061	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3165.9779	3.8700	122.5233	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	909.0143	3.8700	35.1789	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	386.7735	18.9000	73.1002	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			2.6612	(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	3165.9779	0.2160	683.8512	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	909.0143	0.2160	196.3471	(264)
Space and water heating			880.1983	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	386.7735	0.5190	200.7355	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

Regs Region: England

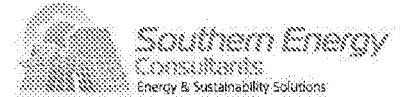
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total kg/year 199.0699 (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	3165.9779	1.2200	3862.4930 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	909.0143	1.2200	1108.9975 (264)
Space and water heating			4971.4905 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	386.7735	3.0700	1187.3948 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			942.4652 (272)
Primary energy kWh/m2/year			10.6565 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	200.1 (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	284.26 (P1)
Transmission heat loss coefficient	75.77 (37)
Summer heat loss coefficient	360.03 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
South	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)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.2200	81.1852	0.4400	0.0000	0.9000	167.8195
East	0.8300	117.5071	0.4400	0.0000	0.9000	38.6222
South	7.7200	112.2060	0.4400	0.0000	0.9000	343.0272
West	0.6000	117.5071	0.4400	0.0000	0.9000	27.9197

total: 577.3886

	Jun	Jul	Aug	
Solar gains	608	577	533	(P4)
Internal gains	455	436	445	
Total summer gains	1063	1014	979	(P5)

Summer gain/loss ratio	2.95	2.82	2.72	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 200.1)	0.60	0.60	0.60	
Threshold temperature	19.55	21.31	21.12	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight