

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG008h			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	WP3520A+, Plot 66				
SAP Rating	84 B	DER	16.96	TET	17.67
Environmental	36 B	% DER<TER	4.03		
CO ₂ Emissions (t/year)	1.29	DREE	46.82	TTEE	50.47
General Requirements Compliance	Pass	% DPEE<TTEE	7.22		
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

Semi-Detached House, total floor area 93 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) 17.67 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.96 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 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	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

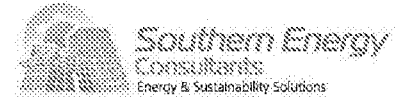
Overshading: Average
Windows facing East: 3.49 m², No overhang
Windows facing South: 2.13 m², No overhang
Windows facing West: 4.52 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

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

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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (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) = 0.2854 (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	0.3638	0.3567	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3210	0.3353 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5367	0.5367	0.5348	0.5407	0.5471	0.5515	0.5562 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18767.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.1095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss							(33) + (36) = 62.0955 (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	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	105.6860	105.4881	105.2941	104.3831	104.2126	103.4191	103.4191	103.2722	103.7248	104.2126	104.5575	104.9180 (39)
Average = Sum(39)m / 12 =												104.3823 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1325	1.1304	1.1283	1.1186	1.1167	1.1082	1.1082	1.1066	1.1115	1.1167	1.1204	1.1243 (40)
HLP (average)												1.1185 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

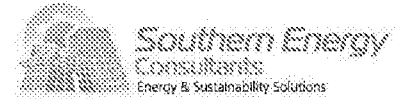
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (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 (56)											
If cylinder contains dedicated solar storage											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
Combi loss 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (62)											
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (65)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	411.7525	409.2663	394.0579	369.6882	344.9036	321.3108	306.2349	312.8116	325.5885	350.1811	378.2743	399.3802	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229	(76)
South	2.1300	46.7521	0.4400	0.0000	0.7700	33.7383	(78)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766	(80)

Solar gains	87.0379	159.5199	242.0946	329.9786	389.8057	393.9528	377.0551	332.6267	273.2308	183.3168	106.4497	72.9840	(83)
Total gains	498.7904	568.7862	636.1525	699.6668	734.7093	715.2635	683.2900	645.4382	598.8193	533.4978	484.7240	472.3642	(84)

7. Mean internal temperature (heating season)

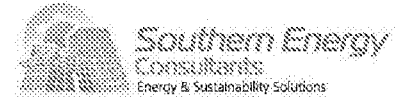
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.3273	49.4198	49.5109	49.9430	50.0247	50.4085	50.4085	50.4802	50.2600	50.0247	49.8597	49.6884
alpha	4.2885	4.2947	4.3007	4.3295	4.3350	4.3606	4.3606	4.3653	4.3507	4.3350	4.3240	4.3126
util living area	0.9968	0.9939	0.9864	0.9639	0.9057	0.7806	0.6233	0.6728	0.8777	0.9759	0.9942	0.9975 (86)
MIT	19.4851	19.6455	19.9244	20.2945	20.6358	20.8756	20.9650	20.9510	20.7718	20.3248	19.8362	19.4541 (87)
Th 2	19.9744	19.9761	19.9778	19.9857	19.9872	19.9941	19.9941	19.9954	19.9915	19.9872	19.9842	19.9811 (88)
util rest of house	0.9959	0.9922	0.9822	0.9519	0.8718	0.7011	0.4996	0.5522	0.8213	0.9658	0.9923	0.9968 (89)
MIT 2	17.9445	18.1796	18.5864	19.1236	19.5954	19.8949	19.9772	19.9692	19.7817	19.1741	18.4643	17.9037 (90)
Living area fraction	18.2717	18.4910	18.8706	19.3723	19.8164	20.1032	20.1870	20.1777	19.9920	19.4185	18.7557	18.2330 (91)
MIT	18.1217	18.3410	18.7206	19.2223	19.6664	19.9532	20.0370	20.0277	19.8420	19.2685	18.6057	18.0830 (93)
Temperature adjustment												-0.1500
adjusted MIT	18.1217	18.3410	18.7206	19.2223	19.6664	19.9532	20.0370	20.0277	19.8420	19.2685	18.6057	18.0830 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	495.5041	561.9926	620.2252	657.6200	630.8200	498.7898	345.2782	359.1825	485.5825	509.7982	478.9963	469.8750	(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	1460.7650	1417.8607	1286.7572	1077.4697	830.1974	553.6197	355.4517	374.6447	595.5863	903.3671	1203.0033	1456.5712	(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	718.1541	575.1433	495.8998	302.2918	148.3368	0.0000	0.0000	0.0000	0.0000	292.8153	521.2851	734.1019	(98)
Space heating												3788.0281	(98)
Space heating per m2												(98) / (4) = 40.5918	(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													4185.6664	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	718.1541	575.1433	495.8998	302.2918	148.3368	0.0000	0.0000	0.0000	0.0000	292.8153	521.2851	734.1019	(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)	793.5405	635.5175	547.9556	334.0241	163.9080	0.0000	0.0000	0.0000	0.0000	323.5528	576.0056	811.1624	(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	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)	
Efficiency of water heater (217)m	89.8596	89.8119	89.7064	89.4678	88.9513	87.3000	87.3000	87.3000	87.3000	89.4189	89.7438	89.8856	(216)	
Fuel for water heating, kWh/month	192.8700	169.2133	175.8586	155.1884	150.8636	134.2869	126.0634	142.3470	143.3625	161.1634	173.3892	187.2133	(219)	
Water heating fuel used												1911.8197	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4185.6664	(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)													437.6809	(232)
Total delivered energy for all uses													6610.1669	(238)

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

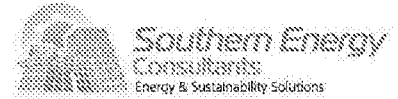
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4185.6664	0.2160	904.1039 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.8197	0.2160	412.9530 (264)
Space and water heating			1317.0570 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total CO2, kg/year			1583.1384 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9600 (273)

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

DER		16.9600	ZC1
Total Floor Area		93.3200	
Assumed number of occupants		2.6685	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.5609	ZC2
CO2 emissions from cooking, equation (L16)		1.9615	ZC3
Total CO2 emissions		34.4824	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.4824	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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (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) =	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			10.1400	1.3258	13.4432		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick Cavity	96.8000	14.4400	82.3600	0.1800	14.8248		(29a)
External Roof 1	46.6600		46.6600	0.1300	6.0658		(30)
Total net area of external elements Aum(A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1296		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9943 (36)
Total fabric heat loss						(33) + (36) =	55.1239 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922
Heat transfer coeff	100.0987	99.8470	99.6004	98.4419	98.2251	97.2161	97.2161
Average = Sum(39)m / 12 =							
HLP	1.0726	1.0699	1.0673	1.0549	1.0526	1.0397	1.0397
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)
Energy content (annual)												Total = Sum(45)m = 1535.2611 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7185	47.1576	46.7406	43.3080	44.7516	46.7406	47.1576	50.7185	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	205.1102	205.1102	(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	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	205.1102	205.1102	(64)
Heat gains from water heating, kWh/month	65.6650	57.7956	60.4455	53.4328	51.6430	45.3076	43.1393	48.3498	48.8919	55.9191	59.5280	63.9950	63.9950	63.9950	(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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	88.2594	86.0054	81.2439	74.2123	69.4127	62.9272	57.9829	64.9863	67.9055	75.1600	82.6778	86.0148	(72)
Total internal gains	424.1249	421.6428	406.3626	381.3401	355.8981	331.6499	316.5818	323.8133	337.2513	362.4967	390.6568	411.7567	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East				3.4900	19.6403		0.6300	0.7000	0.7700		20.9481 (76)	
South				2.1300	46.7521		0.6300	0.7000	0.7700		30.4335 (78)	
West				4.5200	19.6403		0.6300	0.7000	0.7700		27.1305 (80)	

Solar gains	78.5121	143.8942	218.3803	297.6557	351.6224	355.3633	340.1208	300.0444	246.4666	165.3601	96.0224	65.8349 (83)
Total gains	502.6370	565.5370	624.7429	678.9958	707.5205	687.0132	656.7027	623.8577	583.7179	527.8568	486.6793	477.5915 (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	64.7417	64.9048	65.0656	65.8313	65.9766	66.6614	66.6614	66.7897	66.3959	65.9766	65.6834	65.3796	
alpha	5.3161	5.3270	5.3377	5.3888	5.3984	5.4441	5.4441	5.4526	5.4264	5.3984	5.3789	5.3586	
util living area	0.9988	0.9975	0.9935	0.9786	0.9295	0.8001	0.6279	0.6784	0.8980	0.9861	0.9975	0.9991	(86)
MIT	19.8061	19.9344	20.1585	20.4606	20.7379	20.9256	20.9842	20.9763	20.8468	20.4867	20.0931	19.7849	(87)
Th 2	20.0232	20.0255	20.0276	20.0378	20.0398	20.0487	20.0487	20.0503	20.0452	20.0398	20.0359	20.0318	(88)
util rest of house	0.9984	0.9967	0.9911	0.9698	0.8984	0.7183	0.5040	0.5562	0.8419	0.9788	0.9965	0.9988	(89)
MIT 2	18.4205	18.6095	18.9379	19.3809	19.7644	19.9942	20.0423	20.0395	19.9117	19.4237	18.8495	18.3957	(90)
Living area fraction									fLA = Living area / (4) =			0.2124	(91)
MIT	18.7148	18.8909	19.1971	19.6103	19.9711	20.1920	20.2423	20.2385	20.1103	19.6495	19.1136	18.6907	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7148	18.8909	19.1971	19.6103	19.9711	20.1920	20.2423	20.2385	20.1103	19.6495	19.1136	18.6907	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9952	0.9881	0.9646	0.8957	0.7320	0.5304	0.5820	0.8465	0.9747	0.9951	0.9982	(94)
Useful gains	501.4316	562.8048	617.3282	654.9862	633.7546	502.8965	348.3304	363.0982	494.1117	514.5171	484.2819	476.7178	(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	1442.8995	1396.9519	1264.6369	1054.3373	812.4325	543.6345	354.0903	372.4459	586.6378	888.8849	1185.3037	1436.3506	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	700.4521	560.5468	481.5977	287.5328	132.9364	0.0000	0.0000	0.0000	0.0000	278.5296	504.7357	713.9668	(98)
Space heating												3660.2979	(98)
Space heating per m ²												39.2231	(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													3918.9485 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	700.4521	560.5468	481.5977	287.5328	132.9364	0.0000	0.0000	0.0000	0.0000	278.5296	504.7357	713.9668	(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)	749.9487	600.1572	515.6292	307.8510	142.3301	0.0000	0.0000	0.0000	0.0000	298.2116	540.4022	764.4184	(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	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	(64)
Efficiency of water heater (217)m	87.8501	87.6613	87.2446	86.3298	84.4848	80.3000	80.3000	80.3000	80.3000	86.1361	87.3797	87.9318	(216)
Fuel for water heating, kWh/month	239.1945	211.3152	222.7935	199.7004	197.5678	183.0748	175.3996	195.5295	197.6889	209.8562	218.8924	233.2606	(219)
Water heating fuel used												2484.2734	(219)
Annual totals kWh/year													
Space heating fuel - main system												3918.9485	(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)												437.6809	(232)
Total delivered energy for all uses												6915.9027	(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	3918.9485	0.2160	846.4929 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2484.2734	0.2160	536.6030 (264)
Space and water heating			1383.0959 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total CO2, kg/m2/year			1649.1773 (272)
Emissions per m2 for space and water heating			14.8210 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4342 (272b)
Emissions per m2 for pumps and fans			0.4171 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8210 * 1.00) + 2.4342 + 0.4171, rounded to 2 d.p.			17.6700 (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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (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)	=	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			9.0000	419.9400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				18347.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							196.6095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss			(33) + (36) =				62.0955 (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	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922	41.9053	42.4808	43.1012	43.5397	43.9981 (38)
Heat transfer coeff	107.0703	106.8187	106.5720	105.4135	105.1967	104.1877	104.1877	104.0008	104.5763	105.1967	105.6352	106.0936 (39)
Average = Sum(39)m / 12 =												105.4124 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1473	1.1446	1.1420	1.1296	1.1273	1.1165	1.1165	1.1145	1.1206	1.1273	1.1320	1.1369 (40)
HLP (average)												1.1296 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.8244	29.5831	30.5271	26.6142	25.5370	22.0365	20.4200	23.4323	23.7121	27.6342	30.1649	32.7571 (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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	45.4629	44.0224	41.0310	36.9642	34.3239	30.6062	27.4463	31.4950	32.9335	37.1428	41.8957	44.0284	(72)
Total internal gains	378.3284	376.6598	363.1497	341.0920	317.8093	296.3289	283.0453	287.3221	299.2793	321.4794	346.8748	366.7703	(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
East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)
South	2.1300	46.7521	0.4400	0.0000	0.7700	33.7383 (78)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)

Solar gains	87.0379	159.5199	242.0946	329.9786	389.8057	393.9528	377.0551	332.6267	273.2308	183.3168	106.4497	72.9840	(83)
Total gains	465.3663	536.1797	605.2443	671.0706	707.6150	690.2816	660.1004	619.9488	572.5101	504.7962	453.3244	439.7542	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.6001	47.7122	47.8227	48.3482	48.4479	48.9171	48.9171	49.0050	48.7353	48.4479	48.2467	48.0383	
alpha	4.1733	4.1808	4.1882	4.2232	4.2299	4.2611	4.2611	4.2670	4.2490	4.2299	4.2164	4.2026	
util living area	0.9973	0.9947	0.9879	0.9674	0.9139	0.7957	0.6419	0.6934	0.8901	0.9792	0.9951	0.9979	(86)
MIT	19.3960	19.5618	19.8509	20.2383	20.5964	20.8566	20.9576	20.9408	20.7417	20.2702	19.7635	19.3685	(87)
Th 2	19.9624	19.9645	19.9667	19.9767	19.9786	19.9874	19.9874	19.9890	19.9840	19.9786	19.9748	19.9708	(88)
util rest of house	0.9966	0.9932	0.9843	0.9566	0.8824	0.7183	0.5167	0.5726	0.8375	0.9704	0.9935	0.9973	(89)
MIT 2	18.4925	18.6594	18.9485	19.3374	19.6787	19.9075	19.9730	19.9667	19.8185	19.3742	18.8690	18.4716	(90)
Living area fraction	18.6844	18.8511	19.1401	19.5287	19.8736	20.1091	20.1821	20.1736	20.0145	19.5645	19.0590	18.6621	(91)
MIT	18.6844	18.8511	19.1401	19.5287	19.8736	20.1091	20.1821	20.1736	20.0145	19.5645	19.0590	18.6621	(92)
Temperature adjustment	18.6844	18.8511	19.1401	19.5287	19.8736	20.1091	20.1821	20.1736	20.0145	19.5645	19.0590	18.6621	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9953	0.9910	0.9804	0.9506	0.8785	0.7288	0.5426	0.5968	0.8394	0.9656	0.9914	0.9963 (94)
Useful gains	463.1620	531.3739	593.3730	637.8983	621.6338	503.0554	358.1824	369.9611	480.5678	487.4532	449.4453	438.1083 (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	1540.1449	1490.2352	1347.0860	1120.4083	859.8347	573.9787	373.2119	392.4555	618.5210	943.0325	1263.2903	1534.3402 (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	801.2753	644.3548	560.7625	347.4072	177.2215	0.0000	0.0000	0.0000	0.0000	338.9510	585.9684	815.5966 (98)
Space heating												4271.5374 (98)
Space heating per m2										(98) / (4) =		45.7730 (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	979.3641	770.9888	790.4062	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	0.7787	0.8562	0.8281	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.6324	660.1146	654.5319	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	909.2667	871.9402	827.1917	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	105.5766	157.5982	128.4589	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												391.6338 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	26.3942	39.3996	32.1147	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												97.9085 (107)
Space cooling per m2												1.0492 (108)
Energy for space heating												45.7730 (99)
Energy for space cooling												1.0492 (108)
Total												46.8222 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.8 (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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (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) =	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			10.1400	1.3258	13.4432		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick Cavity	96.8000	14.4400	82.3600	0.1800	14.8248		(29a)
External Roof 1	46.6600		46.6600	0.1300	6.0658		(30)
Total net area of external elements Aum(A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1296		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9943 (36)
Total fabric heat loss						(33) + (36) =	55.1239 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922
Heat transfer coeff	100.0987	99.8470	99.6004	98.4419	98.2251	97.2161	97.2161
Average = Sum(39)m / 12 =							
HLP	1.0726	1.0699	1.0673	1.0549	1.0526	1.0397	1.0397
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)
Energy content (annual)												Total = Sum(45)m = 1535.2611 (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	(56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8244	29.5831	30.5271	26.6142	25.5370	22.0365	20.4200	23.4323	23.7121	27.6342	30.1649	32.7571 (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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	45.4629	44.0224	41.0310	36.9642	34.3239	30.6062	27.4463	31.4950	32.9335	37.1428	41.6957	44.0284	(72)
Total internal gains	378.3284	376.6598	363.1497	341.0920	317.8093	296.3289	283.0453	287.3221	299.2793	321.4794	346.8748	366.7703	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481 (76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335 (78)
West	4.5200	19.6403	0.6300	0.7000	0.7700	27.1305 (80)

Solar gains	78.5121	143.8942	218.3803	297.6557	351.6224	355.3633	340.1208	300.0444	246.4666	165.3601	96.0224	65.8349	(83)
Total gains	456.8405	520.5540	581.5300	638.7477	669.4318	651.6922	623.1661	587.3665	545.7459	486.8395	442.8972	432.6051	(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	64.7417	64.9048	65.0656	65.8313	65.9766	66.6614	66.6614	66.7897	66.3959	65.9766	65.6834	65.3796	
alpha	5.3161	5.3270	5.3377	5.3888	5.3984	5.4441	5.4441	5.4526	5.4264	5.3984	5.3789	5.3586	
util living area	0.9993	0.9983	0.9953	0.9836	0.9422	0.8246	0.6560	0.7107	0.9183	0.9903	0.9984	0.9995	(86)
MIT	19.7596	19.8890	20.1158	20.4235	20.7103	20.9129	20.9805	20.9703	20.8232	20.4473	20.0488	19.7391	(87)
Th 2	20.0232	20.0255	20.0276	20.0378	20.0398	20.0487	20.0487	20.0503	20.0452	20.0398	20.0359	20.0318	(88)
util rest of house	0.9990	0.9977	0.9936	0.9766	0.9152	0.7460	0.5293	0.5872	0.8691	0.9851	0.9978	0.9993	(89)
MIT 2	18.8825	19.0135	19.2413	19.5538	19.8282	20.0040	20.0431	20.0408	19.9365	19.5811	19.1818	18.8690	(90)
Living area fraction										fLA = Living area / (4) =		0.2124	(91)
MIT	19.0688	19.1995	19.4270	19.7385	20.0155	20.1970	20.2422	20.2382	20.1248	19.7651	19.3659	19.0538	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0688	19.1995	19.4270	19.7385	20.0155	20.1970	20.2422	20.2382	20.1248	19.7651	19.3659	19.0538	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	456.2265	519.0193	576.9174	621.9668	612.1287	495.1810	346.8490	360.4232	477.0411	478.5840	441.6355	432.1738	(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	1478.3396	1427.7589	1287.5363	1066.9623	816.7952	544.1226	354.0832	372.4210	588.0534	900.2428	1210.1977	1472.3370	(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	760.4522	610.6730	528.7004	320.3968	152.2719	0.0000	0.0000	0.0000	0.0000	313.7141	553.3648	773.8815	(98)
Space heating												4013.4547	(98)
Space heating per m2												(98) / (4) =	43.0074 (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	913.8309	719.3988	737.4219	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8203	0.8979	0.8722	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.5897	645.9621	643.1465	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	864.1621	828.7703	789.1085	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.4921	136.0093	108.5957	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

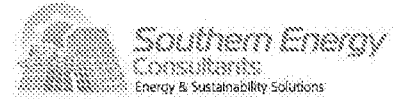


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												327.0971 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	20.6230	34.0023	27.1489	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												81.7743 (107)
Space cooling per m2												0.8763 (108)
Energy for space heating												43.0074 (99)
Energy for space cooling												0.8763 (108)
Total												43.8837 (109)
Target Fabric Energy Efficiency (TFEE)												50.5 (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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (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)	=	0.2854 (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	0.2996	0.2854	0.2854	0.2640	0.2640	0.2354	0.2426	0.2283	0.2354	0.2497	0.2497	0.2711 (22b)
Effective ac	0.5449	0.5407	0.5407	0.5348	0.5348	0.5277	0.5294	0.5261	0.5277	0.5312	0.5312	0.5367 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e)				18767.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.1095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss			(33) + (36) =				62.0955 (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	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	104.0461	103.7248	103.7248	103.2722	103.2722	102.7236	102.8549	102.5963	102.7236	102.9901	102.9901	103.4191 (39)
Average = Sum(39)m / 12 =												103.1948 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1149	1.1115	1.1115	1.1066	1.1066	1.1008	1.1022	1.0994	1.1008	1.1036	1.1036	1.1082 (40)
HLP (average)												1.1058 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (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	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794 (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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397 (71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383 (72)
Total internal gains	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				3.4900	22.3313	0.4400	0.0000	0.7700	26.4048 (76)			
South				2.1300	50.9848	0.4400	0.0000	0.7700	36.7929 (78)			
West				4.5200	22.3313	0.4400	0.0000	0.7700	34.1976 (80)			
Solar gains	97.3953	160.7161	241.0972	338.9216	390.3950	422.4440	399.8621	360.4376	295.0305	197.2469	122.0541	80.8659 (83)
Total gains	711.0433	768.9739	824.8244	885.0365	898.1107	896.2283	854.2781	824.3344	781.0265	721.0780	687.5931	677.8493 (84)

7. Mean internal temperature (heating season)

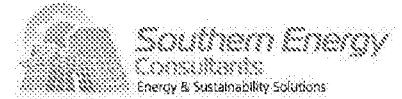
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.1048	50.2600	50.2600	50.4802	50.4802	50.7498	50.6851	50.8128	50.7498	50.6185	50.6185	50.4085
alpha	4.3403	4.3507	4.3507	4.3653	4.3653	4.3833	4.3790	4.3875	4.3833	4.3746	4.3746	4.3606
util living area	0.9852	0.9780	0.9574	0.9018	0.7782	0.5506	0.3701	0.3940	0.6908	0.9115	0.9729	0.9876 (86)
MIT	19.8559	19.9853	20.2546	20.5816	20.8470	20.9758	20.9968	20.9958	20.9324	20.6262	20.1945	19.8289 (87)
Th 2	19.9887	19.9915	19.9915	19.9954	19.9954	20.0002	19.9991	20.0013	20.0002	19.9979	19.9979	19.9941 (88)
util rest of house	0.9813	0.9721	0.9454	0.8736	0.7161	0.4502	0.2523	0.2733	0.5975	0.8797	0.9643	0.9842 (89)
MIT 2	18.4929	18.6813	19.0663	19.5213	19.8558	19.9872	19.9984	20.0003	19.9536	19.5918	18.9894	18.4578 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.7824	18.9583	19.3187	19.7465	20.0663	20.1971	20.2104	20.2118	20.1615	19.8115	19.2454	18.7490 (92)
Temperature adjustment												
adjusted MIT	18.6324	18.8083	19.1687	19.5965	19.9163	20.0471	20.0604	20.0618	20.0115	19.6615	19.0954	18.5990 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9738	0.9627	0.9328	0.8601	0.7106	0.4552	0.2596	0.2807	0.5986	0.8664	0.9538	0.9775	(94)	
Useful gains	692.4157	740.3256	769.4255	761.2558	638.2144	407.9234	221.7574	231.4064	467.5578	624.7541	655.8424	662.5949	(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	1407.9964	1370.0229	1220.7023	1001.3760	714.2664	415.7363	222.2095	232.0476	494.2536	830.2535	1142.7136	1396.0556	(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	532.3920	423.1566	335.7500	172.8865	56.5827	0.0000	0.0000	0.0000	0.0000	152.8915	350.5472	545.6947	(98)	
Space heating													2569.9012	(98)
RHI space heating demand													2570	(98)

FULL SAP CALCULATION PRINTOUT

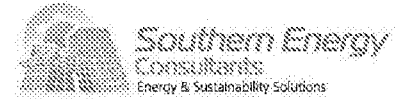
Calculation Type: New Build (As Designed)



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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (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)	=	0.2854 (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	0.3638	0.3567	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3210	0.3353 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5367	0.5367	0.5348	0.5407	0.5471	0.5515	0.5562 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18767.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.1095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss						(33) + (36) =	62.0955 (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	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	105.6860	105.4881	105.2941	104.3831	104.2126	103.4191	103.4191	103.2722	103.7248	104.2126	104.5575	104.9180 (39)
Average = Sum(39)m / 12 =												104.3823 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1325	1.1304	1.1283	1.1186	1.1167	1.1082	1.1082	1.1066	1.1115	1.1167	1.1204	1.1243 (40)
HLP (average)												1.1185 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Energy Ratings 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (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 (56)											
If cylinder contains dedicated solar storage											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
Combi loss 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (62)											
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

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

East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)
South	2.1300	46.7521	0.4400	0.0000	0.7700	33.7383 (78)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)

Solar gains	87.0379	159.5199	242.0946	329.9786	389.8057	393.9528	377.0551	332.6267	273.2308	183.3168	106.4497	72.9840 (83)
Total gains	700.6859	767.7777	825.8218	876.0935	897.5214	867.7371	831.4712	796.5235	759.2268	707.1479	671.9886	669.9673 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.3273	49.4198	49.5109	49.9430	50.0247	50.4085	50.4085	50.4802	50.2600	50.0247	49.8597	49.6884
alpha	4.2885	4.2947	4.3007	4.3295	4.3350	4.3606	4.3606	4.3653	4.3507	4.3350	4.3240	4.3126
util living area	0.9884	0.9816	0.9660	0.9267	0.8424	0.6902	0.5287	0.5695	0.7883	0.9392	0.9805	0.9904 (86)
MIT	19.7186	19.8706	20.1281	20.4593	20.7445	20.9244	20.9814	20.9743	20.8594	20.4968	20.0482	19.6843 (87)
Th 2	19.9744	19.9761	19.9778	19.9857	19.9872	19.9941	19.9941	19.9954	19.9915	19.9872	19.9842	19.9811 (88)
util rest of house	0.9854	0.9768	0.9568	0.9058	0.7966	0.6060	0.4164	0.4571	0.7160	0.9175	0.9746	0.9879 (89)
MIT 2	18.2836	18.5047	18.8760	19.3474	19.7261	19.9378	19.9857	19.9827	19.8728	19.4087	18.7695	18.2385 (90)
Living area fraction	18.5884	18.7948	19.1419	19.5836	19.9424	20.1473	20.1972	20.1933	20.0823	19.6398	19.0411	18.5456 (91)
MIT	18.5884	18.7948	19.1419	19.5836	19.9424	20.1473	20.1972	20.1933	20.0823	19.6398	19.0411	18.5456 (92)
Temperature adjustment	18.4384	18.6448	18.9919	19.4336	19.7924	19.9973	20.0472	20.0433	19.9323	19.4898	18.8911	-0.1500 (93)
adjusted MIT	18.4384	18.6448	18.9919	19.4336	19.7924	19.9973	20.0472	20.0433	19.9323	19.4898	18.8911	18.3956 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9790	0.9682	0.9451	0.8917	0.7864	0.6063	0.4226	0.4628	0.7111	0.9038	0.9657	0.9822 (94)
Useful gains	685.9556	743.3860	780.4567	781.2471	705.8261	526.0918	351.3804	368.6018	539.9050	639.1483	648.9081	658.0389 (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	1494.2271	1449.9116	1315.3255	1099.5281	843.3297	558.1876	356.5069	376.2538	604.9548	926.4259	1232.8488	1489.3726 (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	601.3540	474.7852	397.9424	229.1623	102.3027	0.0000	0.0000	0.0000	0.0000	213.7346	420.4372	618.5123 (98)
Space heating												3058.2307 (98)
Space heating per m2												(98) / (4) = 32.7714 (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													3379.2604	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	601.3540	474.7852	397.9424	229.1623	102.3027	0.0000	0.0000	0.0000	0.0000	213.7346	420.4372	618.5123	(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)	664.4795	524.6245	439.7154	253.2181	113.0416	0.0000	0.0000	0.0000	0.0000	236.1708	464.5715	683.4390	(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	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)	
Efficiency of water heater (217)m	89.7639	89.7027	89.5680	89.2655	88.6560	87.3000	87.3000	87.3000	87.3000	89.1835	89.6127	89.7960	(216)	
Fuel for water heating, kWh/month	193.0758	169.4193	176.1305	155.5401	151.3661	134.2869	126.0634	142.3470	143.3625	161.5888	173.6428	187.4000	(219)	
Water heating fuel used												1914.2233	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3379.2604	(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)												437.6809	(232)	
Total delivered energy for all uses												5806.1647	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3379.2604	3.4800	117.5983 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1914.2233	3.4800	66.6150 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	437.6809	13.1900	57.7301 (250)
Additional standing charges			120.0000 (251)
Total energy cost			371.8358 (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] = 1.1291 (257)
SAP value	84.2497
SAP rating (Section 12)	B (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3379.2604	0.2160	729.9203 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1914.2233	0.2160	413.4722 (264)
Space and water heating			1143.3925 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total kg/year			1409.4739 (272)
CO2 emissions per m2			15.1000 (273)
EI value			86.3455
EI rating			B (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8873 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8873 = 0.2434$, 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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (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) =	0.2854 (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	0.2996	0.2854	0.2854	0.2640	0.2640	0.2354	0.2426	0.2283	0.2354	0.2497	0.2497	0.2711 (22b)
Effective ac	0.5449	0.5407	0.5407	0.5348	0.5348	0.5277	0.5294	0.5261	0.5277	0.5312	0.5312	0.5367 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	18767.5400 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.1095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss			(33) + (36) =	62.0955 (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	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	104.0461	103.7248	103.7248	103.2722	103.2722	102.7236	102.8549	102.5963	102.7236	102.9901	102.9901	103.4191 (39)
Average = Sum(39)m / 12 =												103.1948 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1149	1.1115	1.1115	1.1066	1.1066	1.1008	1.1022	1.0994	1.1008	1.1036	1.1036	1.1082 (40)
HLP (average)												1.1058 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (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 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (62)											
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (65)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East	3.4900				22.3313		0.4400		0.0000		0.7700		26.4048 (76)	
South	2.1300				50.9848		0.4400		0.0000		0.7700		36.7929 (78)	
West	4.5200				22.3313		0.4400		0.0000		0.7700		34.1976 (80)	
Solar gains	97.3953	160.7161	241.0972	338.9216	390.3950	422.4440	399.8621	360.4376	295.0305	197.2469	122.0541	80.8659	(83)	
Total gains	711.0433	768.9739	824.8244	885.0365	898.1107	896.2283	854.2781	824.3344	781.0265	721.0780	687.5931	677.8493	(84)	

7. Mean internal temperature (heating season)

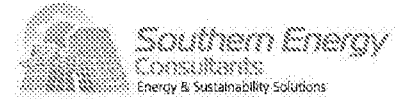
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.1048	50.2600	50.2600	50.4802	50.4802	50.7498	50.6851	50.8128	50.7498	50.6185	50.6185	50.4085
alpha	4.3403	4.3507	4.3507	4.3653	4.3653	4.3833	4.3790	4.3875	4.3833	4.3746	4.3746	4.3606
util living area	0.9852	0.9780	0.9574	0.9018	0.7782	0.5506	0.3701	0.3940	0.6908	0.9115	0.9729	0.9876 (86)
MIT	19.8559	19.9853	20.2546	20.5816	20.8470	20.9758	20.9968	20.9958	20.9324	20.6262	20.1945	19.8289 (87)
Th 2	19.9887	19.9915	19.9915	19.9954	19.9954	20.0002	19.9991	20.0013	20.0002	19.9979	19.9979	19.9941 (88)
util rest of house	0.9813	0.9721	0.9454	0.8736	0.7161	0.4502	0.2523	0.2733	0.5975	0.8797	0.9643	0.9842 (89)
MIT 2	18.4929	18.6813	19.0663	19.5213	19.8558	19.9872	19.9984	20.0003	19.9536	19.5918	18.9894	18.4578 (90)
Living area fraction	18.7824	18.9583	19.3187	19.7465	20.0663	20.1971	20.2104	20.2118	20.1615	19.8115	19.2454	18.7490 (91)
Temperature adjustment	fLA = Living area / (4) =											0.2124 (91)
adjusted MIT	18.6324	18.8083	19.1687	19.5965	19.9163	20.0471	20.0604	20.0618	20.0115	19.6615	19.0954	18.5990 (92)
												-0.1500
												18.5990 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	692.4157	740.3256	769.4255	761.2558	638.2144	407.9234	221.7574	231.4064	467.5578	624.7541	655.8424	662.5949	(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	1407.9964	1370.0229	1220.7023	1001.3760	714.2664	415.7363	222.2095	232.0476	494.2536	830.2535	1142.7136	1396.0556	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	532.3920	423.1566	335.7500	172.8865	56.5827	0.0000	0.0000	0.0000	0.0000	152.8915	350.5472	545.6947	(98)
Space heating												2569.9012	(98)
Space heating per m2												27.5386	(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													2839.6699	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	532.3920	423.1566	335.7500	172.8865	56.5827	0.0000	0.0000	0.0000	0.0000	152.8915	350.5472	545.6947	(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)	588.2785	467.5763	370.9945	191.0348	62.5223	0.0000	0.0000	0.0000	0.0000	168.9409	387.3450	602.9776	(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	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)	
Efficiency of water heater (217)m	89.6926	89.6318	89.4519	89.0462	88.2252	87.3000	87.3000	87.3000	87.3000	88.9185	89.4915	89.7248	(216)	
Fuel for water heating, kWh/month	193.2293	169.5533	176.3591	155.9231	152.1052	134.2869	126.0634	142.3470	143.3625	162.0704	173.8779	187.5487	(219)	
Water heating fuel used												1916.7268	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2839.6699	(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)													437.6809	(232)
Total delivered energy for all uses													5269.0776	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2839.6699	3.8700	109.8952 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.7268	3.8700	74.1773 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	437.6809	18.9000	82.7217 (250)
Additional standing charges			93.0000 (251)
Total energy cost			373.9692 (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	2839.6699	0.2160	613.3687 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.7268	0.2160	414.0130 (264)
Space and water heating			1027.3817 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total kg/year			1293.4631 (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	2839.6699	1.2200	3464.3972 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.7268	1.2200	2338.4067 (264)
Space and water heating			5802.8040 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	437.6809	3.0700	1343.6803 (268)
Primary energy kWh/year			7376.7343 (272)
Primary energy kWh/m2/year			79.0477 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-188 kg (14.5%)
U Solar photovoltaic panels	+ 9.7	-£ 345	-947 kg (85.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.01 kg/m²	B 85 B 88
Solar photovoltaic panels	£345	10.15 kg/m²	A 95 A 97
Total Savings	£374	12.15 kg/m²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 97

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	£97	£106	-£9
Mains gas	£277	£239	£38
Space heating	£217	£217	£0
Water heating	£74	£45	£29
Lighting	£83	£83	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£374	£0	£374
Total cost of uses	£374	£0	£374
Delivered energy	56 kWh/m²	27 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	2 kg/m²	12 kg/m²
Primary energy	79 kWh/m²	8 kWh/m²	71 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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (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) = 0.2854 (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	0.3638	0.3567	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3210	0.3353 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5367	0.5367	0.5348	0.5407	0.5471	0.5515	0.5562 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18767.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.1095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss							(33) + (36) = 62.0955 (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	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	105.6860	105.4881	105.2941	104.3831	104.2126	103.4191	103.4191	103.2722	103.7248	104.2126	104.5575	104.9180 (39)
Average = Sum(39)m / 12 =												104.3823 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1325	1.1304	1.1283	1.1186	1.1167	1.1082	1.1082	1.1066	1.1115	1.1167	1.1204	1.1243 (40)
HLP (average)												1.1185 (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	2.6685 (42)
Average daily hot water use (litres/day)	97.5767 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1535.2611 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227	(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	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535	14.1265	(61)
Total heat required for water heating calculated for each month													
	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-25.0192	-41.7499	-71.1048	-95.2945	-117.7283	-115.7457	-114.2161	-99.7912	-78.1565	-53.3717	-29.6764	-20.9368	(63)
Output from w/h													
	148.2931	110.2239	86.6516	43.5492	16.4668	1.4867	0.0000	24.4777	46.9990	90.7389	125.9296	147.3410	(64)
Heat gains from water heating, kWh/month													
	56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869	(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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229	(76)
South	2.1300	46.7521	0.4400	0.0000	0.7700	33.7383	(78)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766	(80)

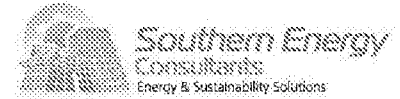
Solar gains	87.0379	159.5199	242.0946	329.9786	389.8057	393.9528	377.0551	332.6267	273.2308	183.3168	106.4497	72.9840	(83)
Total gains	700.6859	767.7777	825.8218	876.0935	897.5214	867.7371	831.4712	796.5235	759.2268	707.1479	671.9886	669.9673	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.3273	49.4198	49.5109	49.9430	50.0247	50.4085	50.4085	50.4802	50.2600	50.0247	49.8597	49.6884	
alpha	4.2885	4.2947	4.3007	4.3295	4.3350	4.3606	4.3606	4.3653	4.3507	4.3350	4.3240	4.3126	
util living area	0.9884	0.9816	0.9660	0.9267	0.8424	0.6902	0.5287	0.5695	0.7883	0.9392	0.9805	0.9904	(86)
MIT	19.7186	19.8706	20.1281	20.4593	20.7445	20.9244	20.9814	20.9743	20.8594	20.4968	20.0482	19.6843	(87)
Th 2	19.9744	19.9761	19.9778	19.9857	19.9872	19.9941	19.9941	19.9954	19.9915	19.9872	19.9842	19.9811	(88)
util rest of house	0.9854	0.9768	0.9568	0.9058	0.7966	0.6060	0.4164	0.4571	0.7160	0.9175	0.9746	0.9879	(89)
MIT 2	18.2836	18.5047	18.8760	19.3474	19.7261	19.9378	19.9857	19.9827	19.8728	19.4087	18.7695	18.2385	(90)
Living area fraction													
MIT	18.5884	18.7948	19.1419	19.5836	19.9424	20.1473	20.1972	20.1933	20.0823	19.6398	19.0411	18.5456	(92)
Temperature adjustment													
adjusted MIT	18.4384	18.6448	18.9919	19.4336	19.7924	19.9973	20.0472	20.0433	19.9323	19.4898	18.8911	18.3956	(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	0.9790	0.9682	0.9451	0.8917	0.7864	0.6063	0.4226	0.4628	0.7111	0.9038	0.9657	0.9822	(94)
Useful gains	685.9556	743.3860	780.4567	781.2471	705.8261	526.0918	351.3804	368.6018	539.9050	639.1483	648.9081	658.0389	(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	1494.2271	1449.9116	1315.3255	1099.5281	843.3297	558.1876	356.5069	376.2538	604.9548	926.4259	1232.8488	1489.3726	(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	601.3540	474.7852	397.9424	229.1623	102.3027	0.0000	0.0000	0.0000	0.0000	213.7346	420.4372	618.5123	(98)
Space heating												3058.2307	(98)
Space heating per m2											(98) / (4) =	32.7714	(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													3379.2604 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.3540	474.7852	397.9424	229.1623	102.3027	0.0000	0.0000	0.0000	0.0000	213.7346	420.4372	618.5123	(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)	664.4795	524.6245	439.7154	253.2181	113.0416	0.0000	0.0000	0.0000	0.0000	236.1708	464.5715	683.4390	(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	148.2931	110.2239	86.6516	43.5492	16.4668	1.4867	0.0000	24.4777	46.9990	90.7389	125.9296	147.3410	(64)
Efficiency of water heater	89.8485	89.8793	89.9107	89.9733	90.0424	87.3000	87.3000	87.3000	87.3000	89.5221	89.7418	89.8663	(217)
(217)m	89.8485	89.8793	89.9107	89.9733	90.0424	87.3000	87.3000	87.3000	87.3000	89.5221	89.7418	89.8663	(217)
Fuel for water heating, kWh/month	165.0479	122.6355	96.3752	48.4023	18.2879	1.7030	0.0000	28.0386	53.8362	101.3593	140.3243	163.9558	(219)
Water heating fuel used												939.9660	(219)
Annual totals kWh/year													
Space heating fuel - main system												3379.2604	(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)													437.6809 (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												3154.6679	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3379.2604	3.4800	117.5983	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	939.9660	3.4800	32.7108	(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	437.6809	13.1900	57.7301	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			116.7038	(255)

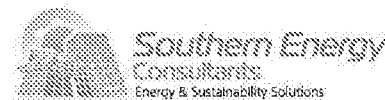
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3544 (257)
SAP value		95.0566
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	3379.2604	0.2160	729.9203 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.9660	0.2160	203.0327 (264)
Space and water heating			932.9529 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			328.5470 (272)
CO2 emissions per m2			3.5200 (273)
EI value			96.8171
EI rating			97 (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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (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) = 0.2854 (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	0.2996	0.2854	0.2854	0.2640	0.2640	0.2354	0.2426	0.2283	0.2354	0.2497	0.2497	0.2711 (22b)
Effective ac	0.5449	0.5407	0.5407	0.5348	0.5348	0.5277	0.5294	0.5261	0.5277	0.5312	0.5312	0.5367 (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)			10.1400	1.2357	12.5304		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	14.4400	82.3600	0.2500	20.5900	60.0000	4941.6000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.1018			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18767.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							201.1095 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9937 (36)
Total fabric heat loss							(33) + (36) = 62.0955 (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	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	104.0461	103.7248	103.7248	103.2722	103.2722	102.7236	102.8549	102.5963	102.7236	102.9901	102.9901	103.4191 (39)
Average = Sum(39)m / 12 =												103.1948 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1149	1.1115	1.1115	1.1066	1.1066	1.1008	1.1022	1.0994	1.1008	1.1036	1.1036	1.1082 (40)
HLP (average)												1.1058 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)												Total = Sum(45)m =	1535.2611 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (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	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535	14.1265 (61)	
Total heat required for water heating calculated for each month													
	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)	
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-27.0774	-40.6973	-68.5395	-94.7425	-114.1018	-120.0872	-117.2037	-104.6636	-81.6903	-55.5724	-32.9133	-879.7230 (H17)	
Output from w/h													
	146.2349	111.2764	89.2170	44.1012	20.0933	0.0000	0.0000	19.6053	43.4651	88.5382	122.6927	145.8440 (64)	
Heat gains from water heating, kWh/month													
	56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)	
	Total per year (kWh/year) = Sum(64)m =											831.0680 (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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	22.3313	0.4400	0.0000	0.7700	26.4048 (76)
South	2.1300	50.9848	0.4400	0.0000	0.7700	36.7929 (78)
West	4.5200	22.3313	0.4400	0.0000	0.7700	34.1976 (80)

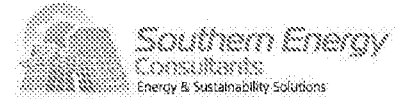
Solar gains	97.3953	160.7161	241.0972	338.9216	390.3950	422.4440	399.8621	360.4376	295.0305	197.2469	122.0541	80.8659 (83)
Total gains	711.0433	768.9739	824.8244	885.0365	898.1107	896.2283	854.2781	824.3344	781.0265	721.0780	687.5931	677.8493 (84)

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	50.1048	50.2600	50.2600	50.4802	50.4802	50.7498	50.6851	50.8128	50.7498	50.6185	50.6185	50.4085
alpha	4.3403	4.3507	4.3507	4.3653	4.3653	4.3833	4.3790	4.3875	4.3833	4.3746	4.3746	4.3606
util living area	0.9852	0.9780	0.9574	0.9018	0.7782	0.5506	0.3701	0.3940	0.6908	0.9115	0.9729	0.9876 (86)
MIT	19.8559	19.9853	20.2546	20.5816	20.8470	20.9758	20.9968	20.9958	20.9324	20.6262	20.1945	19.8289 (87)
Th 2	19.9887	19.9915	19.9915	19.9954	19.9954	20.0002	19.9991	20.0013	20.0002	19.9979	19.9979	19.9941 (88)
util rest of house	0.9813	0.9721	0.9454	0.8736	0.7161	0.4502	0.2523	0.2733	0.5975	0.8797	0.9643	0.9842 (89)
MIT 2	18.4929	18.6813	19.0663	19.5213	19.8558	19.9872	19.9984	20.0003	19.9536	19.5918	18.9894	18.4578 (90)
Living area fraction												
MIT	18.7824	18.9583	19.3187	19.7465	20.0663	20.1971	20.2104	20.2118	20.1615	19.8115	19.2454	18.7490 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6324	18.8083	19.1687	19.5965	19.9163	20.0471	20.0604	20.0618	20.0115	19.6615	19.0954	18.5990 (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	0.9738	0.9627	0.9328	0.8601	0.7106	0.4552	0.2596	0.2807	0.5986	0.8664	0.9538	0.9775	(94)
Useful gains	692.4157	740.3256	769.4255	761.2558	638.2144	407.9234	221.7574	231.4064	467.5578	624.7541	655.8424	662.5949	(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													
	1407.9964	1370.0229	1220.7023	1001.3760	714.2664	415.7363	222.2095	232.0476	494.2536	830.2535	1142.7136	1396.0556	(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													
	532.3920	423.1566	335.7500	172.8865	56.5827	0.0000	0.0000	0.0000	0.0000	152.8915	350.5472	545.6947	(98)
Space heating													
Space heating per m2												2569.9012	(98)
											(98) / (4) =	27.5386	(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													2839.6699 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	532.3920	423.1566	335.7500	172.8865	56.5827	0.0000	0.0000	0.0000	0.0000	152.8915	350.5472	545.6947	(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)	588.2785	467.5763	370.9945	191.0348	62.5223	0.0000	0.0000	0.0000	0.0000	168.9409	387.3450	602.9776	(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	146.2349	111.2764	89.2170	44.1012	20.0933	0.0000	0.0000	19.6053	43.4651	88.5382	122.6927	145.8440	(64)
Efficiency of water heater	89.7908	89.8145	89.8089	89.8308	89.6390	87.3000	87.3000	87.3000	87.3000	89.2996	89.6481	89.8058	(216)
(217)m	89.7908	89.8145	89.8089	89.8308	89.6390	87.3000	87.3000	87.3000	87.3000	89.2996	89.6481	89.8058	(217)
Fuel for water heating, kWh/month	162.8618	123.8958	99.3409	49.0936	22.4158	0.0000	0.0000	22.4574	49.7883	99.1473	136.8604	162.3993	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													2839.6699 (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)													437.6809 (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													2506.4518 (238)

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

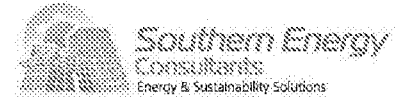
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2839.6699	3.8700	109.8952	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	928.2607	3.8700	35.9237	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	437.6809	18.9000	82.7217	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			0.3994	(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	2839.6699	0.2160	613.3687	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	928.2607	0.2160	200.5043	(264)
Space and water heating			813.8730	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	437.6809	0.5190	227.1564	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

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 159.1655 (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	2839.6699	1.2200	3464.3972 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.2607	1.2200	1132.4781 (264)
Space and water heating			4596.8753 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	437.6809	3.0700	1343.6803 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			724.1355 (272)
Primary energy kWh/m2/year			7.7597 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	201.1 (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	307.96 (P1)
Transmission heat loss coefficient	62.10 (37)
Summer heat loss coefficient	370.05 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.4900	117.5071	0.4400	0.0000	0.9000	162.3995
South	2.1300	112.2060	0.4400	0.0000	0.9000	94.6435
West	4.5200	117.5071	0.4400	0.0000	0.9000	210.3283

total: 467.3712

	Jun	Jul	Aug	
Solar gains	494	467	421	(P4)
Internal gains	471	451	461	
Total summer gains	965	919	882	(P5)

Summer gain/loss ratio	2.61	2.48	2.38	(P6)
Summer external temperature	16.00	17.90	17.60	
Thermal mass temperature increment (TMP = 201.1)	0.59	0.59	0.59	
Threshold temperature	19.20	20.98	20.78	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight