

FULL SAP CALCULATION PRINTOUT

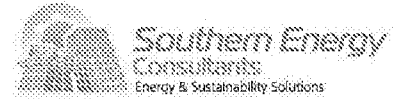
Calculation Type: New Build (As Designed)



Property Reference	SECANG005c		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Lockwood Corner, Plot 50				
SAP Rating	83 B	DER	18.26	TET	18.65
Environmental	85 B	% DER<TER	2.11		
CO ₂ Emissions (t/year)	1.37	DPEE	52.84	TPEE	56.98
General Requirements Compliance	Pass	% DPEE<TPEE	7.27		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 91 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.65 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.26 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.8 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	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

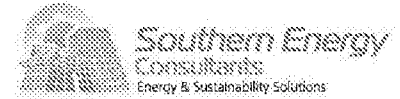
Overshading: Average
Windows facing North: 5.16 m², No overhang
Windows facing East: 6.97 m², No overhang
Windows facing South: 3.93 m², No overhang
Windows facing West: 0.48 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1814 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4314 (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) =		0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	122.5491	122.2403	121.9376	120.5157	120.2497	119.0113	119.0113	118.7820	119.4883	120.2497	120.7879	121.3505 (39)
Average = Sum(39)m / 12 =												120.5145 (39)
HLP	1.3446	1.3412	1.3379	1.3223	1.3194	1.3058	1.3058	1.3033	1.3110	1.3194	1.3253	1.3315 (40)
HLP (average)												1.3223 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

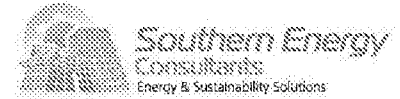
Elmhurst Energy Systems

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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	404.1151	401.9226	387.3199	363.7104	339.6213	316.5064	301.5563	307.8118	319.9986	343.8293	371.2058	391.8504 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					5.1600	10.6334	0.4400	0.0000	0.7700		18.5894 (74)	
East					6.9700	19.6403	0.4400	0.0000	0.7700		46.3792 (76)	
South					3.9300	46.7521	0.4400	0.0000	0.7700		62.2496 (78)	
West					0.4800	19.6403	0.4400	0.0000	0.7700		3.1940 (80)	
Solar gains	130.4122	234.4498	349.9360	476.6593	569.0204	579.2354	552.5638	482.2078	393.9824	267.3194	158.5314	110.0530 (83)
Total gains	534.5273	636.3724	737.2559	840.3697	908.6417	895.7418	854.1201	790.0197	713.9809	611.1488	529.7372	501.9034 (84)

7. Mean internal temperature (heating season)

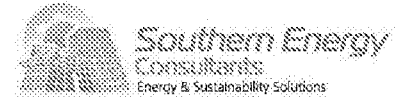
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.7735	39.8740	39.9730	40.4446	40.5341	40.9558	40.9558	41.0349	40.7923	40.5341	40.3535	40.1664
alpha	3.6516	3.6583	3.6649	3.6963	3.7023	3.7304	3.7304	3.7357	3.7195	3.7023	3.6902	3.6778
util living area	0.9945	0.9891	0.9760	0.9403	0.8605	0.7205	0.5707	0.6265	0.8408	0.9626	0.9903	0.9956 (86)
MIT	19.1714	19.3830	19.7325	20.1898	20.5918	20.8585	20.9559	20.9373	20.7275	20.1963	19.6009	19.1372 (87)
Th 2	19.8060	19.8087	19.8113	19.8234	19.8257	19.8363	19.8363	19.8383	19.8322	19.8257	19.8211	19.8163 (88)
util rest of house	0.9930	0.9860	0.9690	0.9217	0.8150	0.6290	0.4379	0.4947	0.7714	0.9474	0.9870	0.9944 (89)
MIT 2	17.3850	17.6946	18.2024	18.8608	19.4051	19.7298	19.8165	19.8070	19.5934	18.8830	18.0216	17.3415 (90)
Living area fraction	17.7288	18.0196	18.4968	19.1166	19.6335	19.9470	20.0358	20.0245	19.8116	19.1357	18.3255	17.6871 (92)
MIT	17.7288	18.0196	18.4968	19.1166	19.6335	19.9470	20.0358	20.0245	19.8116	19.1357	18.3255	17.6871 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5788	17.8696	18.3468	18.9666	19.4835	19.7970	19.8858	19.8745	19.6616	18.9857	18.1755	17.5371 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9884	0.9785	0.9565	0.9037	0.7988	0.6255	0.4440	0.4993	0.7590	0.9318	0.9800	0.9907 (94)
Ext temp.	528.3334	622.6687	705.1809	759.4736	725.8597	560.3297	379.2534	394.4351	541.8886	569.4887	519.1178	497.2137 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1627.3039	1585.4034	1444.5759	1213.1783	935.9627	618.5065	391.0454	412.7079	664.5485	1008.3802	1337.7903	1618.4625 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m ²	817.6340	646.9577	550.1098	326.6674	156.3166	0.0000	0.0000	0.0000	0.0000	326.5352	589.4442	834.2091 (98)
Space heating												4247.8741 (98)
Space heating per m ²												46.6082 (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													4693.7835 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	817.6340	646.9577	550.1098	326.6674	156.3166	0.0000	0.0000	0.0000	0.0000	326.5352	589.4442	834.2091	(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)	903.4630	714.8704	607.8562	360.9584	172.7255	0.0000	0.0000	0.0000	0.0000	360.8124	651.3196	921.7780	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)
Efficiency of water heater (217)m	89.9264	89.8764	89.7702	89.5254	88.9980	87.3000	87.3000	87.3000	87.3000	89.4997	89.8157	89.9494	(217)
Fuel for water heating, kWh/month	191.5397	168.0531	174.6580	154.1483	149.8772	133.4888	125.3239	141.4982	142.5034	160.0412	172.1904	185.9312	(219)
Water heating fuel used												1899.2536	(219)
Annual totals kWh/year													
Space heating fuel - main system												4693.7835	(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)												387.2964	(232)
Total delivered energy for all uses												7055.3335	(238)

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

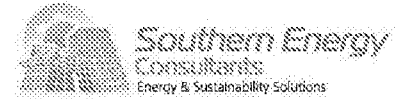
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4693.7835	0.2160	1013.8572 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1899.2536	0.2160	410.2388 (264)
Space and water heating			1424.0960 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total CO2, kg/year			1664.0278 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2600 (273)

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

DER		18.2600	ZC1
Total Floor Area	TFA	91.1400	
Assumed number of occupants	N	2.6410	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.6798	ZC2
CO2 emissions from cooking, equation (L16)		2.0011	ZC3
Total CO2 emissions		35.9410	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		35.9410	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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1500	1.0000	2.1500			(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800			(26a)					
TER Opening Type (Uw = 1.40)			16.5400	1.3258	21.9280			(27)					
Heat Loss Floor 1			45.5700	0.1300	5.9241			(28a)					
Brick Cavity	132.7600	20.8400	111.9200	0.1800	20.1456			(29a)					
Main Plane	45.5700		45.5700	0.1300	5.9241			(30)					
Total net area of external elements Aum(A, m2)			223.9000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6518			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								11.1552 (36)					
Total fabric heat loss						(33) + (36) =		69.8070 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.7614	Feb 42.5140	Mar 42.2716	Apr 41.1330	May 40.9199	Jun 39.9282	Jul 39.9282	Aug 39.7445	Sep 40.3102	Oct 40.9199	Nov 41.3509	Dec 41.8015	(38)
Heat transfer coeff	112.5684	112.3211	112.0786	110.9400	110.7269	109.7352	109.7352	109.5515	110.1172	110.7269	111.1579	111.6085	(39)
Average = Sum(39)m / 12 =												110.9390	(39)
HLP	Jan 1.2351	Feb 1.2324	Mar 1.2297	Apr 1.2172	May 1.2149	Jun 1.2040	Jul 1.2040	Aug 1.2020	Sep 1.2082	Oct 1.2149	Nov 1.2196	Dec 1.2246	(40)
HLP (average)												1.2172	(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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	Jan 106.6163	Feb 102.7393	Mar 98.8623	Apr 94.9854	May 91.1084	Jun 87.2315	Jul 87.2315	Aug 91.1084	Sep 94.9854	Oct 98.8623	Nov 102.7393	Dec 106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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 (57)
Combi loss	50.9589	46.0274	50.3792	46.8421	46.4279	43.0183	44.4522	46.4279	46.8421	50.3792	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Heat gains from water heating, kWh/month	65.3109	57.4859	60.0411	53.0754	51.2975	45.0045	42.8506	48.0263	48.5648	55.5449	59.2122	63.6521 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9625	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	87.7835	85.5446	80.7004	73.7158	68.9483	62.5062	57.5949	64.5515	67.4512	74.6572	82.2392	85.5539 (72)
Total internal gains	416.4883	414.2999	399.5121	375.2541	350.5118	326.7459	311.8035	318.7096	331.5529	356.0323	383.5891	404.2277 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.1600	10.6334	0.6300	0.7000	0.7700	16.7685 (74)			
East				6.9700	19.6403	0.6300	0.7000	0.7700	41.8362 (76)			
South				3.9300	46.7521	0.6300	0.7000	0.7700	56.1520 (78)			
West				0.4800	19.6403	0.6300	0.7000	0.7700	2.8811 (80)			
Solar gains	117.6377	211.4844	315.6582	429.9683	513.2823	522.4967	498.4377	434.9734	355.3900	241.1343	143.0025	99.2728 (83)
Total gains	534.1261	625.7843	715.1703	805.2224	863.7941	849.2426	810.2412	753.6830	686.9430	597.1666	526.5916	503.5005 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.2251	56.3489	56.4708	57.0504	57.1601	57.6767	57.6767	57.7734	57.4766	57.1601	56.9385	56.7087
alpha	4.7483	4.7566	4.7647	4.8034	4.8107	4.8451	4.8451	4.8516	4.8318	4.8107	4.7959	4.7806
util living area	0.9982	0.9958	0.9887	0.9638	0.8918	0.7420	0.5753	0.6339	0.8675	0.9791	0.9962	0.9986 (86)
MIT	19.6334	19.7967	20.0675	20.4235	20.7358	20.9263	20.9830	20.9733	20.8329	20.4227	19.9616	19.6049 (87)
Th 2	19.8920	19.8942	19.8963	19.9062	19.9081	19.9168	19.9168	19.9184	19.9134	19.9081	19.9043	19.9004 (88)
util rest of house	0.9975	0.9943	0.9845	0.9494	0.8483	0.6478	0.4440	0.5016	0.7981	0.9682	0.9946	0.9982 (89)
MIT 2	18.0753	18.3151	18.7101	19.2255	19.6454	19.8670	19.9105	19.9073	19.7761	19.2332	18.5637	18.0395 (90)
Living area fraction	18.3752	18.6003	18.9713	19.4560	19.8552	20.0708	20.1169	20.1124	19.9795	19.4621	18.8327	0.1925 (91)
MIT	18.3752	18.6003	18.9713	19.4560	19.8552	20.0708	20.1169	20.1124	19.9795	19.4621	18.8327	18.3408 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3752	18.6003	18.9713	19.4560	19.8552	20.0708	20.1169	20.1124	19.9795	19.4621	18.8327	18.3408 (93)

8. Space heating requirement

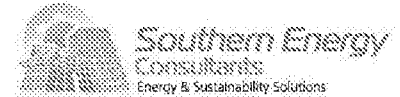
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	532.0955	620.6146	700.5249	758.2642	730.5512	562.5962	380.2969	397.0538	551.6808	574.4648	522.5157	502.0426 (95)
Ext temp.	4.3000	4.9000	6.5000	8.2000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1584.4213	1538.8291	1397.7701	1171.0877	903.0025	600.3435	385.9288	406.7036	647.4333	981.2727	1304.1848	1578.2313 (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	782.9305	617.0402	518.7505	297.2329	128.3038	0.0000	0.0000	0.0000	0.0000	302.6650	562.8017	800.6844 (98)
Space heating												4010.4090 (98)
Space heating per m2												(98) / (4) = 44.0027 (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

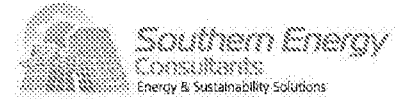
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4293.7998 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	782.9305	617.0402	518.7505	297.2329	128.3038	0.0000	0.0000	0.0000	0.0000	302.6650	562.8017	800.6844 (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)	838.2553	660.6426	555.4074	318.2365	137.3702	0.0000	0.0000	0.0000	0.0000	324.0525	602.5714	857.2638 (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	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Efficiency of water heater (217)m	88.0655	87.8583	87.4177	86.4264	84.4144	80.3000	80.3000	80.3000	80.3000	86.3557	87.6152	88.1481 (217)
Fuel for water heating, kWh/month	237.4002	209.7813	220.8648	198.1428	196.4094	181.8500	174.2262	194.2213	196.3663	207.9221	217.2203	231.5182 (219)
Water heating fuel used												2465.9228 (219)
Annual totals kWh/year												
Space heating fuel - main system												4293.7998 (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)												387.2964 (232)
Total delivered energy for all uses												7222.0190 (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	4293.7998	0.2160	927.4608 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2465.9228	0.2160	532.6393 (264)
Space and water heating			1460.1001 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total CO2, kg/m2/year			1700.0319 (272)
Emissions per m2 for space and water heating			16.0204 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2055 (272b)
Emissions per m2 for pumps and fans			0.4271 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0204 * 1.00) + 2.2055 + 0.4271, rounded to 2 d.p.			18.6500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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)	=	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			9.0000	410.1300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17137.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 188.0296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	120.9651	120.7178	120.4754	119.3367	119.1237	118.1319	118.1319	117.9483	118.5139	119.1237	119.5546	120.0052 (39)
Average = Sum(39)m / 12 =												119.3357 (39)
HLP	1.3272	1.3245	1.3219	1.3094	1.3070	1.2962	1.2962	1.2941	1.3004	1.3070	1.3118	1.3167 (40)
HLP (average)												1.3094 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8636	369.4832	356.5682	335.2552	312.6578	291.6411	278.4713	282.4424	293.8150	315.2694	339.9653	359.4076	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	5.1600	10.6334	0.4400		0.0000		0.7700	18.5894 (74)
East	6.9700	19.6403	0.4400		0.0000		0.7700	46.3792 (76)
South	3.9300	46.7521	0.4400		0.0000		0.7700	62.2496 (78)
West	0.4800	19.6403	0.4400		0.0000		0.7700	3.1940 (80)

Solar gains	130.4122	234.4498	349.9360	476.6593	569.0204	579.2354	552.5638	482.2078	393.9824	267.3194	158.5314	110.0530	(83)
Total gains	501.2758	603.9330	706.5042	811.9145	881.6782	870.8766	831.0351	764.6503	687.7974	582.5889	498.4967	469.4607	(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	39.3525	39.4332	39.5125	39.8895	39.9609	40.2963	40.2963	40.3591	40.1664	39.9609	39.8168	39.6673	
alpha	3.6235	3.6289	3.6342	3.6593	3.6641	3.6864	3.6864	3.6906	3.6778	3.6641	3.6545	3.6445	
util living area	0.9952	0.9900	0.9775	0.9429	0.8651	0.7279	0.5787	0.6369	0.8485	0.9656	0.9914	0.9962	(86)
MIT	19.1256	19.3410	19.6970	20.1608	20.5728	20.8484	20.9518	20.9311	20.7098	20.1630	19.5565	19.0878	(87)
Th 2	19.8196	19.8217	19.8237	19.8335	19.8353	19.8438	19.8438	19.8454	19.8406	19.8353	19.8316	19.8278	(88)
util rest of house	0.9939	0.9873	0.9710	0.9252	0.8211	0.6380	0.4464	0.5060	0.7819	0.9517	0.9886	0.9952	(89)
MIT 2	18.1203	18.3360	18.6899	19.1488	19.5319	19.7646	19.8287	19.8213	19.6639	19.1600	18.5591	18.0887	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.3138	18.5294	18.8837	19.3435	19.7322	19.9732	20.0448	20.0348	19.8652	19.3530	18.7510	18.2809	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3138	18.5294	18.8837	19.3435	19.7322	19.9732	20.0448	20.0348	19.8652	19.3530	18.7510	18.2809	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9914	0.9832	0.9641	0.9159	0.8165	0.6492	0.4711	0.5295	0.7836	0.9440	0.9849	0.9932	(94)
Useful gains	496.9898	593.7691	681.1230	743.6646	719.8866	565.3480	391.4618	404.8814	538.9646	549.9628	490.9446	466.2677	(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	1695.1767	1645.3158	1491.9290	1246.2971	956.8282	634.7439	406.9445	428.7234	683.2539	1042.6911	1392.9336	1689.7871	(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	891.4510	706.6394	603.2396	361.8954	176.2846	0.0000	0.0000	0.0000	0.0000	366.5898	649.4320	910.2985	(98)
Space heating												4665.8304	(98)
Space heating per m2										(98) / (4) =		51.1941	(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	1110.4400	874.1762	896.4068	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

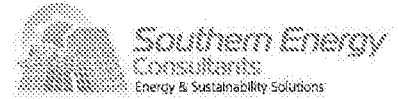


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7892	0.8579	0.8252	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	876.3747	749.9158	739.7312	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1117.8164	1069.1453	993.3276	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	173.8380	237.5067	188.6757	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												600.0205 (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	43.4595	59.3767	47.1689	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												150.0051 (107)
Space cooling per m2												1.6459 (108)
Energy for space heating												51.1941 (99)
Energy for space cooling												1.6459 (108)
Total												52.8400 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.8 (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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

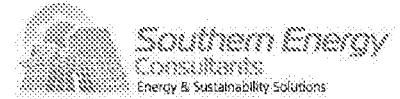
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)					
TER Opening Type (Uw = 1.40)			16.5400	1.3258	21.9280		(27)					
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)					
Brick Cavity	132.7600	20.8400	111.9200	0.1800	20.1456		(29a)					
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)					
Total net area of external elements Aum(A, m2)			223.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6518		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1552 (36)					
Total fabric heat loss						(33) + (36) =	69.8070 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.7614	Feb 42.5140	Mar 42.2716	Apr 41.1330	May 40.9199	Jun 39.9282	Jul 39.9282	Aug 39.7445	Sep 40.3102	Oct 40.9199	Nov 41.3509	Dec 41.8015 (38)
Heat transfer coeff	112.5684	112.3211	112.0786	110.9400	110.7269	109.7352	109.7352	109.5515	110.1172	110.7269	111.1579	111.6085 (39)
Average = Sum(39)m / 12 =												110.9390 (39)
HLP	Jan 1.2351	Feb 1.2324	Mar 1.2297	Apr 1.2172	May 1.2149	Jun 1.2040	Jul 1.2040	Aug 1.2020	Sep 1.2082	Oct 1.2149	Nov 1.2196	Dec 1.2246 (40)
HLP (average)												1.2172 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	Jan 106.6163	Feb 102.7393	Mar 98.8623	Apr 94.9854	May 91.1084	Jun 87.2315	Jul 87.2315	Aug 91.1084	Sep 94.9854	Oct 98.8623	Nov 102.7393	Dec 106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)												Total = Sum(45)m = 1524.9898 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8636	369.4832	356.5682	335.2552	312.6578	291.6411	278.4713	282.4424	293.8150	315.2694	339.9653	359.4076	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.1600	10.6334	0.6300	0.7000	0.7700	16.7685 (74)
East	6.9700	19.6403	0.6300	0.7000	0.7700	41.8362 (76)
South	3.9300	46.7521	0.6300	0.7000	0.7700	56.1520 (78)
West	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811 (80)

Solar gains	117.6377	211.4844	315.6582	429.9683	513.2823	522.4967	498.4377	434.9734	355.3900	241.1343	143.0025	99.2728	(83)
Total gains	488.5014	580.9676	672.2264	765.2235	825.9401	814.1378	776.9089	717.4158	649.2050	556.4037	482.9678	458.6805	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2251	56.3489	56.4708	57.0504	57.1601	57.6767	57.6767	57.7734	57.4766	57.1601	56.9385	56.7087	
alpha	4.7483	4.7566	4.7647	4.8034	4.8107	4.8451	4.8451	4.8516	4.8318	4.8107	4.7959	4.7806	
util living area	0.9988	0.9969	0.9912	0.9699	0.9052	0.7625	0.5965	0.6593	0.8866	0.9841	0.9974	0.9991	(86)
MIT	19.5875	19.7521	20.0261	20.3891	20.7127	20.9168	20.9802	20.9684	20.8122	20.3849	19.9180	19.5597	(87)
Th 2	19.8920	19.8942	19.8963	19.9062	19.9081	19.9168	19.9168	19.9184	19.9134	19.9081	19.9043	19.9004	(88)
util rest of house	0.9983	0.9958	0.9879	0.9576	0.8650	0.6695	0.4621	0.5247	0.8227	0.9756	0.9963	0.9988	(89)
MIT 2	18.6059	18.7717	19.0458	19.4092	19.7101	19.8776	19.9117	19.9092	19.8053	19.4113	18.9457	18.5847	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.7948	18.9604	19.2344	19.5978	19.9030	20.0776	20.1173	20.1131	19.9990	19.5987	19.1328	18.7723	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7948	18.9604	19.2344	19.5978	19.9030	20.0776	20.1173	20.1131	19.9990	19.5987	19.1328	18.7723	(93)

8. Space heating requirement

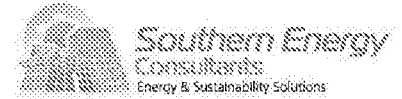
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9977	0.9946	0.9852	0.9532	0.8647	0.6848	0.4882	0.5508	0.8288	0.9723	0.9952	0.9983	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1631.6544	1579.2797	1427.2585	1186.8116	908.2950	601.0870	385.9752	406.7709	649.5864	996.3936	1337.5384	1626.3927	(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	851.3363	672.9933	569.1613	329.3400	144.3842	0.0000	0.0000	0.0000	0.0000	338.8244	616.9744	869.3553	(98)
Space heating												4392.3692	(98)
Space heating per m ²										(98) / (4) =		48.1936	(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	1031.5109	812.0405	832.5918	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8368	0.9043	0.8745	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	863.1395	734.3406	728.1407	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1051.4984	1005.8809	938.1185	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

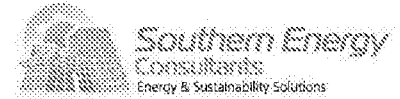


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	135.6184	202.0260	156.2235	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												493.8679 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	33.9046	50.5065	39.0559	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												123.4670 (107)
Space cooling per m2												1.3547 (108)
Energy for space heating												48.1936 (99)
Energy for space cooling												1.3547 (108)
Total												49.5483 (109)
Target Fabric Energy Efficiency (TFEE)												57.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	119.9898	119.4883	119.4883	118.7820	118.7820	117.9258	118.1307	117.7271	117.9258	118.3417	118.3417	119.0113 (39)
Average = Sum(39)m / 12 =												118.6612 (39)
HLP	1.3165	1.3110	1.3110	1.3033	1.3033	1.2939	1.2961	1.2917	1.2939	1.2985	1.2985	1.3058 (40)
HLP (average)												1.3020 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Calculation of Heat Demand 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
												1690 (64)
												1690 (64)
												1690 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			5.1600		11.9814		0.4400		0.0000		0.7700		20.9460 (74)
East			6.9700		22.3313		0.4400		0.0000		0.7700		52.7340 (76)
South			3.9300		50.9848		0.4400		0.0000		0.7700		67.8855 (78)
West			0.4800		22.3313		0.4400		0.0000		0.7700		3.6316 (80)
Solar gains	145.1971	235.2997	348.0263	490.3292	571.6320	623.2576	587.9240	523.7364	425.3600	286.7683	180.9076	121.2964	(83)
Total gains	744.6797	830.1444	919.7060	1026.0147	1070.3394	1088.9108	1034.3005	978.8139	901.1865	798.8104	733.2150	704.1878	(84)

7. Mean internal temperature (heating season)

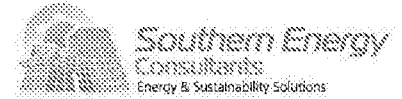
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.6219	40.7923	40.7923	41.0349	41.0349	41.3328	41.2611	41.4026	41.3328	41.1876	41.1876	40.9558	
alpha	3.7081	3.7195	3.7195	3.7357	3.7357	3.7555	3.7507	3.7602	3.7555	3.7458	3.7458	3.7304	
util living area	0.9812	0.9709	0.9439	0.8750	0.7396	0.5153	0.3494	0.3783	0.6701	0.8971	0.9664	0.9841	(86)
MIT	19.5705	19.7428	20.0798	20.4876	20.8068	20.9652	20.9941	20.9921	20.9023	20.5175	19.9884	19.5404	(87)
Th 2	19.8279	19.8322	19.8322	19.8383	19.8383	19.8456	19.8439	19.8473	19.8456	19.8420	19.8420	19.8363	(88)
util rest of house	0.9761	0.9632	0.9285	0.8403	0.6694	0.4073	0.2214	0.2453	0.5673	0.8601	0.9558	0.9798	(89)
MIT 2	17.9777	18.2279	18.7077	19.2705	19.6674	19.8277	19.8427	19.8457	19.7803	19.3272	18.5912	17.9399	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.2842	18.5194	18.9718	19.5048	19.8867	20.0466	20.0643	20.0663	19.9962	19.5563	18.8601	18.2479	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1342	18.3694	18.8218	19.3548	19.7367	19.8966	19.9143	19.9163	19.8462	19.4063	18.7101	18.0979	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9655	0.9498	0.9111	0.8229	0.6625	0.4123	0.2293	0.2534	0.5674	0.8425	0.9414	0.9704	(94)
Useful gains	718.9993	788.4471	837.9113	844.3358	709.0806	448.9366	237.2104	248.0607	511.3313	673.0117	690.2363	683.3150	(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	1563.9757	1525.7986	1364.7688	1123.0544	800.1931	459.5118	237.9513	249.1447	547.9076	923.8122	1267.4500	1546.9022	(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	628.6624	495.5002	391.9820	200.6774	67.7877	0.0000	0.0000	0.0000	0.0000	186.5956	415.5939	642.5089	(98)
Space heating												3029.3080	(98)
RHI space heating demand												3029	(98)

FULL SAP CALCULATION PRINTOUT

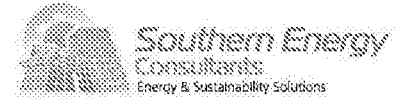
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5813	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	122.5491	122.2403	121.9376	120.5157	120.2497	119.0113	119.0113	118.7820	119.4883	120.2497	120.7879	121.3505 (39)
Average = Sum(39)m / 12 =												120.5145 (39)
HLP	1.3446	1.3412	1.3379	1.3223	1.3194	1.3058	1.3058	1.3033	1.3110	1.3194	1.3253	1.3315 (40)
HLP (average)												1.3223 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

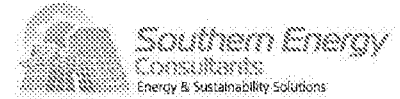
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.1600	10.6334	0.4400	0.0000	0.7700	18.5894 (74)
East	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (76)
South	3.9300	46.7521	0.4400	0.0000	0.7700	62.2496 (78)
West	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (80)

Solar gains	130.4122	234.4498	349.9360	476.6593	569.0204	579.2354	552.5638	482.2078	393.9824	267.3194	158.5314	110.0530 (83)
Total gains	729.8949	829.2945	921.6158	1012.3448	1067.7279	1044.8886	998.9403	937.2853	869.8088	779.3615	710.8388	692.9444 (84)

7. Mean internal temperature (heating season)

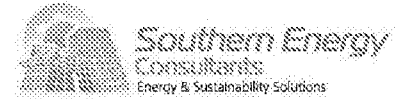
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.7735	39.8740	39.9730	40.4446	40.5341	40.9558	40.9558	41.0349	40.7923	40.5341	40.3535	40.1664	
alpha	3.6516	3.6583	3.6649	3.6963	3.7023	3.7304	3.7304	3.7357	3.7195	3.7023	3.6902	3.6778	
util living area	0.9850	0.9750	0.9538	0.9032	0.8052	0.6506	0.5007	0.5478	0.7665	0.9266	0.9754	0.9874	(86)
MIT	19.3975	19.5995	19.9254	20.3404	20.6862	20.9004	20.9714	20.9599	20.8082	20.3587	19.8054	19.3606	(87)
Th 2	19.8060	19.8087	19.8113	19.8234	19.8257	19.8363	19.8363	19.8383	19.8322	19.8257	19.8211	19.8163	(88)
util rest of house	0.9811	0.9686	0.9415	0.8766	0.7511	0.5581	0.3787	0.4245	0.6857	0.9006	0.9679	0.9842	(89)
MIT 2	17.7126	18.0056	18.4739	19.0612	19.5144	19.7649	19.8241	19.8194	19.6746	19.1014	18.3148	17.6657	(90)
Living area fraction	18.0368	18.3124	18.7532	19.3074	19.7399	19.9834	20.0449	20.0389	19.8928	19.3434	18.6016	17.9919	(91)
MIT	17.8868	18.1624	18.6032	19.1574	19.5899	19.8334	19.8949	19.8889	19.7428	19.1934	18.4516	17.8419	(92)
Temperature adjustment												-0.1500	
adjusted MIT													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9717	0.9560	0.9248	0.8578	0.7386	0.5578	0.3852	0.4302	0.6785	0.8822	0.9553	0.9760	(94)
Ext temp.	709.2737	792.8118	852.2785	868.4150	788.5973	582.8634	384.7640	403.2234	590.1895	687.5907	679.0718	676.2855	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1665.0563	1621.1945	1475.8357	1236.1797	948.7596	622.8363	392.1301	414.4211	674.2436	1033.3521	1371.1396	1655.4483	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	711.1023	556.6732	463.9266	264.7906	119.1607	0.0000	0.0000	0.0000	0.0000	257.2464	498.2889	728.4971	(98)
Space heating per m ²												3599.6859	(98)
													(98) / (4) = 39.4962 (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													3977.5535	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	711.1023	556.6732	463.9266	264.7906	119.1607	0.0000	0.0000	0.0000	0.0000	257.2464	498.2889	728.4971	(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)	785.7484	615.1085	512.6261	292.5863	131.6693	0.0000	0.0000	0.0000	0.0000	284.2502	550.5954	804.9692	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)	
Efficiency of water heater (217)m	89.8577	89.7975	89.6698	89.3775	88.7812	87.3000	87.3000	87.3000	87.3000	89.3289	89.7210	89.8848	(216)	
Fuel for water heating, kWh/month	191.6861	168.2008	174.8536	154.4034	150.2431	133.4888	125.3239	141.4982	142.5034	160.3473	172.3721	186.0648	(219)	
Water heating fuel used												1900.9856	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3977.5535	(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)													387.2964	(232)
Total delivered energy for all uses													6340.8354	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3977.5535	3.4800	138.4189 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1900.9856	3.4800	66.1543 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.2964	13.1900	51.0844 (250)
Additional standing charges			120.0000 (251)
Total energy cost			385.5501 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$		1.1894	(257)
SAP value			83.4072	
SAP rating (Section 12)			83	(258)
SAP band			B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3977.5535	0.2160	859.1516	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1900.9856	0.2160	410.6129	(264)
Space and water heating			1269.7644	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.2964	0.5190	201.0068	(268)
Total kg/year			1509.6963	(272)
CO2 emissions per m2			16.5600	(273)
EI value			85.1403	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8880 = 3.919$, stars = 4
Water heating environmental impact	$0.216 / 0.8880 = 0.2432$, stars = 4

Regs Region: England

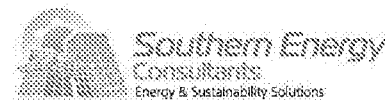
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

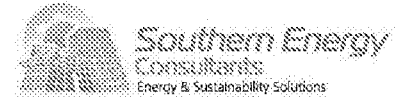
Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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												
Effective ac	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	119.9898	119.4883	119.4883	118.7820	118.7820	117.9258	118.1307	117.7271	117.9258	118.3417	118.3417	119.0113 (39)
Average = Sum(39)m / 12 =												118.6612 (39)
HLP	1.3165	1.3110	1.3110	1.3033	1.3033	1.2939	1.2961	1.2917	1.2939	1.2985	1.2985	1.3058 (40)
HLP (average)												1.3020 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

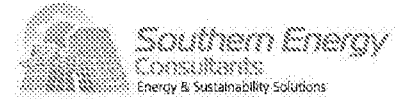
Elmhurst Energy Systems

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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			5.1600		11.9814		0.4400		0.0000		0.7700		20.9460 (74)
East			6.9700		22.3313		0.4400		0.0000		0.7700		52.7340 (76)
South			3.9300		50.9848		0.4400		0.0000		0.7700		67.8855 (78)
West			0.4800		22.3313		0.4400		0.0000		0.7700		3.6316 (80)
Solar gains	145.1971	235.2997	348.0263	490.3292	571.6320	623.2576	587.9240	523.7364	425.3600	286.7683	180.9076		121.2964 (83)
Total gains	744.6797	830.1444	919.7060	1026.0147	1070.3394	1088.9108	1034.3005	978.8139	901.1865	798.8104	733.2150		704.1878 (84)

7. Mean internal temperature (heating season)

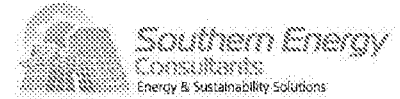
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.6219	40.7923	40.7923	41.0349	41.0349	41.3328	41.2611	41.4026	41.3328	41.1876	41.1876	40.9558
alpha	3.7081	3.7195	3.7195	3.7357	3.7357	3.7555	3.7507	3.7602	3.7555	3.7458	3.7458	3.7304
util living area	0.9812	0.9709	0.9439	0.8750	0.7396	0.5153	0.3494	0.3783	0.6701	0.8971	0.9664	0.9841 (86)
MIT	19.5705	19.7428	20.0798	20.4876	20.8068	20.9652	20.9941	20.9921	20.9023	20.5175	19.9884	19.5404 (87)
Th 2	19.8279	19.8322	19.8322	19.8383	19.8383	19.8456	19.8439	19.8473	19.8456	19.8420	19.8420	19.8363 (88)
util rest of house	0.9761	0.9632	0.9285	0.8403	0.6694	0.4073	0.2214	0.2453	0.5673	0.8601	0.9558	0.9798 (89)
MIT 2	17.9777	18.2279	18.7077	19.2705	19.6674	19.8277	19.8427	19.8457	19.7803	19.3272	18.5912	17.9399 (90)
Living area fraction	18.2842	18.5194	18.9718	19.5048	19.8867	20.0466	20.0643	20.0663	19.9962	19.5563	18.8601	18.2479 (92)
MIT	18.1342	18.3694	18.8218	19.3548	19.7367	19.8966	19.9143	19.9163	19.8462	19.4063	18.7101	18.0979 (93)
Temperature adjustment												-0.1500
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9655	0.9498	0.9111	0.8229	0.6625	0.4123	0.2293	0.2534	0.5674	0.8425	0.9414	0.9704 (94)
Ext temp.	718.9993	788.4471	837.9113	844.3358	709.0806	448.9366	237.2104	248.0607	511.3313	673.0117	690.2363	683.3150 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1563.9757	1525.7986	1364.7688	1123.0544	800.1931	459.5118	237.9513	249.1447	547.9076	923.8122	1267.4500	1546.9022 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	628.6624	495.5002	391.9820	200.6774	67.7877	0.0000	0.0000	0.0000	0.0000	186.5956	415.5939	642.5089 (98)
Space heating per m2												3029.3080 (98)
(98) / (4) = 33.2380 (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													3347.3017	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	628.6624	495.5002	391.9820	200.6774	67.7877	0.0000	0.0000	0.0000	0.0000	186.5956	415.5939	642.5069	(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)	694.6546	547.5140	433.1292	221.7430	74.9035	0.0000	0.0000	0.0000	0.0000	206.1830	459.2197	709.9546	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)	
Efficiency of water heater (217)m	89.7922	89.7316	89.5620	89.1682	88.3527	87.3000	87.3000	87.3000	87.3000	89.0820	89.6092	89.8200	(217)	
Fuel for water heating, kWh/month	191.8262	168.3243	175.0639	154.7659	150.9718	133.4888	125.3239	141.4982	142.5034	160.7917	172.5873	186.1991	(219)	
Water heating fuel used												1903.3445	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3347.3017	(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)													387.2964	(232)
Total delivered energy for all uses													5712.9426	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3347.3017	3.8700	129.5406 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1903.3445	3.8700	73.6594 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	387.2964	18.9000	73.1990 (250)
Additional standing charges			93.0000 (251)
Total energy cost			383.5740 (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	3347.3017	0.2160	723.0172 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.3445	0.2160	411.1224 (264)
Space and water heating			1134.1396 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total kg/year			1374.0714 (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	3347.3017	1.2200	4083.7080 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.3445	1.2200	2322.0803 (264)
Space and water heating			6405.7884 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	387.2964	3.0700	1189.0000 (268)
Primary energy kWh/year			7825.0383 (272)
Primary energy kWh/m2/year			85.8573 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-187 kg (13.6%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (79.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.05 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	10.39 kg/m²	A 94 A 96
Total Savings	£373	12.43 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 96

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

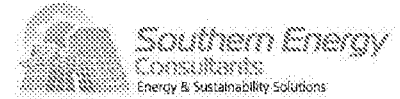
Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£87	£97	-£9
Mains gas	£296	£258	£38
Space heating	£237	£237	£0
Water heating	£74	£45	£29
Lighting	£73	£73	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£383	£10	£374
Total cost of uses	£384	£10	£374
Delivered energy	63 kWh/m²	32 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	12 kg/m²
Primary energy	86 kWh/m²	13 kWh/m²	73 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	122.5491	122.2403	121.9376	120.5157	120.2497	119.0113	119.0113	118.7820	119.4883	120.2497	120.7879	121.3505 (39)
Average = Sum(39)m / 12 =												120.5145 (39)
HLP	1.3446	1.3412	1.3379	1.3223	1.3194	1.3058	1.3058	1.3033	1.3110	1.3194	1.3253	1.3315 (40)
HLP (average)												1.3223 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

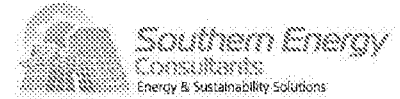
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1893 (H8)
Utilisation factor												0.5687 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-860.3285 (H17)
Solar input	-24.9478	-41.6307	-70.9019	-95.0225	-117.3923	-115.4153	-113.8901	-99.5063	-77.9334	-53.2193	-29.5917	-20.8771 (63)
Solar input (sum of months) = Sum(63)m =												-860.3285 (63)
Output from w/h	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669 (64)
Total per year (kWh/year) = Sum(64)m =												834.6306 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				5.1600	10.6334	0.4400		0.0000		0.7700	18.5894 (74)	
East				6.9700	19.6403	0.4400		0.0000		0.7700	46.3792 (76)	
South				3.9300	46.7521	0.4400		0.0000		0.7700	62.2496 (78)	
West				0.4800	19.6403	0.4400		0.0000		0.7700	3.1940 (80)	
Solar gains	130.4122	234.4498	349.9360	476.6593	569.0204	579.2354	552.5638	482.2078	393.9824	267.3194	158.5314	110.0530 (83)
Total gains	729.8949	829.2945	921.6158	1012.3448	1067.7279	1044.8886	998.9403	937.2853	869.8088	779.3615	710.8388	692.9444 (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	39.7735	39.8740	39.9730	40.4446	40.5341	40.9558	40.9558	41.0349	40.7923	40.5341	Nov	Dec	40.1664
alpha	3.6516	3.6583	3.6649	3.6963	3.7023	3.7304	3.7304	3.7357	3.7195	3.7023	3.6902	3.6778	3.6778
util living area	0.9850	0.9750	0.9538	0.9032	0.8052	0.6506	0.5007	0.5478	0.7665	0.9266	0.9754	0.9874 (86)	
MIT	19.3975	19.5995	19.9254	20.3404	20.6862	20.9004	20.9714	20.9599	20.8082	20.3587	19.8054	19.3606 (87)	
Th 2	19.8060	19.8087	19.8113	19.8234	19.8257	19.8363	19.8363	19.8383	19.8322	19.8257	19.8211	19.8163 (88)	
util rest of house	0.9811	0.9686	0.9415	0.8766	0.7511	0.5581	0.3787	0.4245	0.6857	0.9006	0.9679	0.9842 (89)	
MIT 2	17.7126	18.0056	18.4739	19.0612	19.5144	19.7649	19.8241	19.8194	19.6746	19.1014	18.3148	17.6657 (90)	
Living area fraction									fLA = Living area / (4) =			0.1925 (91)	
MIT	18.0368	18.3124	18.7532	19.3074	19.7399	19.9834	20.0449	20.0389	19.8928	19.3434	18.6016	17.9919 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.8868	18.1624	18.6032	19.1574	19.5899	19.8334	19.8949	19.8889	19.7428	19.1934	18.4516	17.8419 (93)	

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

**Southern Energy
Consultants**
Energy & Sustainability Solutions

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9717	0.9560	0.9248	0.8578	0.7386	0.5578	0.3852	0.4302	0.6785	0.8822	0.9553	0.9760 (94)
Useful gains	709.2737	792.8118	852.2785	868.4150	788.5973	582.8634	384.7640	403.2234	590.1895	687.5907	679.0718	676.2855 (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	1665.0563	1621.1945	1475.8357	1236.1797	948.7596	622.8363	392.1301	414.4211	674.2436	1033.3521	1371.1396	1655.4483 (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	711.1023	556.6732	463.9266	264.7906	119.1607	0.0000	0.0000	0.0000	0.0000	257.2464	498.2889	728.4971 (98)
Space heating												3599.6859 (98)
Space heating per m2												39.4962 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3977.5535	(211)

[illegible][illegible]

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)	387.2964	(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		3693.3228	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3977.5535	3.4800	138.4189 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	930.7123	3.4800	32.3888 (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	387.2964	13.1900	51.0844 (250)
Additional standing charges			120.0000 (251)

Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			130.5567 (255)

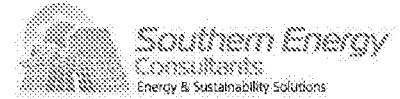
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4028 (257)
SAP value		94.3813
SAP rating (Section 12)		94 (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	3977.5535	0.2160	859.1516 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	930.7123	0.2160	201.0339 (264)
Space and water heating			1060.1854 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			429.6300 (272)
CO2 emissions per m2			4.7100 (273)
EI value			95.7712
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =		0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
 Total fabric heat loss (33) + (36) = 78.2037 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	119.9898	119.4883	119.4883	118.7820	118.7820	117.9258	118.1307	117.7271	117.9258	118.3417	118.3417	119.0113 (39)
Average = Sum(39)m / 12 =												118.6612 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3165	1.3110	1.3110	1.3033	1.3033	1.2939	1.2961	1.2917	1.2939	1.2985	1.2985	1.3058 (40)
HLP (average)												1.3020 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

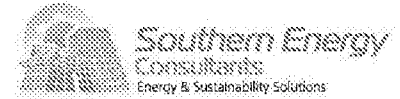
Elmhurst Energy Systems

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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2560 (H8)
Utilisation factor												0.5490 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-877.1154 (H17)
Solar input	-26.9972	-40.5767	-68.3363	-94.4617	-113.7636	-119.7313	-116.8563	-104.3534	-81.4482	-55.4077	-32.8158	-22.3673 (63)
Solar input (sum of months) = Sum(63)m =												-877.1154 (63)
Output from w/h	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767 (64)
Total per year (kWh/year) = Sum(64)m =												824.0055 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.1600	11.9814	0.4400	0.0000	0.7700	20.9460 (74)
East	6.9700	22.3313	0.4400	0.0000	0.7700	52.7340 (76)
South	3.9300	50.9848	0.4400	0.0000	0.7700	67.8855 (78)
West	0.4800	22.3313	0.4400	0.0000	0.7700	3.6316 (80)

Solar gains	145.1971	235.2997	348.0263	490.3292	571.6320	623.2576	587.9240	523.7364	425.3600	286.7683	180.9076	121.2964 (83)
Total gains	744.6797	830.1444	919.7060	1026.0147	1070.3394	1088.9108	1034.3005	978.8139	901.1865	798.8104	733.2150	704.1878 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.6219	40.7923	40.7923	41.0349	41.0349	41.3328	41.2611	41.4026	41.3328	41.1876	41.1876	40.9558
alpha	3.7081	3.7195	3.7195	3.7357	3.7357	3.7555	3.7507	3.7602	3.7555	3.7458	3.7458	3.7304
util living area	0.9812	0.9709	0.9439	0.8750	0.7396	0.5153	0.3494	0.3783	0.6701	0.8971	0.9664	0.9841 (86)
MIT	19.5705	19.7428	20.0798	20.4876	20.8068	20.9652	20.9941	20.9921	20.9023	20.5175	19.9884	19.5404 (87)
Th 2	19.8279	19.8322	19.8322	19.8383	19.8383	19.8456	19.8439	19.8473	19.8456	19.8420	19.8420	19.8363 (88)
util rest of house	0.9761	0.9632	0.9285	0.8403	0.6694	0.4073	0.2214	0.2453	0.5673	0.8601	0.9558	0.9798 (89)
MIT 2	17.9777	18.2279	18.7077	19.2705	19.6674	19.8277	19.8427	19.8457	19.7803	19.3272	18.5912	17.9399 (90)
Living area fraction												0.1925 (91)
MIT	18.2842	18.5194	18.9718	19.5048	19.8867	20.0466	20.0643	20.0663	19.9962	19.5563	18.8601	18.2479 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1342	18.3694	18.8218	19.3548	19.7367	19.8966	19.9143	19.9163	19.8462	19.4063	18.7101	18.0979 (93)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

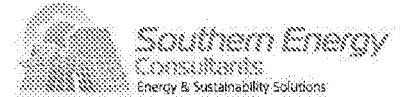
Southern Energy
Consultants
Energy & Sustainability Solutions

elmhurst
energy

ARUN DISTRICT COUNCIL A/38/21/DOC

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 240.7568 (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	3347.3017	1.2200	4083.7080 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.4289	1.2200	1121.7033 (264)
Space and water heating			5205.4113 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	387.2964	3.0700	1189.0000 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1177.9912 (272)
Primary energy kWh/m2/year			12.9251 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	192.5 (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	291.14 (P1)
Transmission heat loss coefficient	78.20 (37)
Summer heat loss coefficient	369.34 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.1600	81.1852	0.4400	0.0000	0.9000	165.8905
East	6.9700	117.5071	0.4400	0.0000	0.9000	324.3336
South	3.9300	112.2060	0.4400	0.0000	0.9000	174.6240
West	0.4800	117.5071	0.4400	0.0000	0.9000	22.3357

total: 687.1838

	Jun	Jul	Aug	
Solar gains	728	687	612	(P4)
Internal gains	463	443	452	
Total summer gains	1191	1131	1064	(P5)
Summer gain/loss ratio	3.23	3.06	2.88	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 192.5)	0.65	0.65	0.65	
Threshold temperature	19.88	21.61	21.33	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			