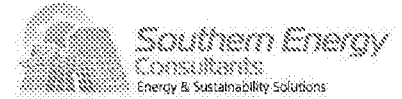


FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG006e		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Re Ea Ga		
Property	Derwent, Plot 49				
SAP Rating	83 B	DER	18.80	TET	19.04
Environmental	85 B	% DER<TER	1.29		
CO ₂ Emissions (t/year)	1.38	DPEE	54.12	TPEE	57.79
General Requirements Compliance	Pass	% DPEE<TPEE	6.34		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 89 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.04 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.80 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.1 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)	0.30 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

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

10 Key Features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.039 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	217.6790 (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) =	0.1838 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4338 (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) =		0.3687 (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	0.4701	0.4609	0.4516	0.4056	0.3963	0.3503	0.3503	0.3410	0.3687	0.3963	0.4148	0.4332 (22b)
Effective ac	0.6105	0.6062	0.6020	0.5822	0.5785	0.5613	0.5613	0.5582	0.5680	0.5785	0.5860	0.5938 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17924.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.5864 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.8539	43.5457	43.2436	41.8247	41.5592	40.3234	40.3234	40.0945	40.7994	41.5592	42.0963	42.6578 (38)
Heat transfer coeff	120.0833	119.7751	119.4730	118.0541	117.7886	116.5528	116.5528	116.3239	117.0288	117.7886	118.3257	118.8872 (39)
Average = Sum(39)m / 12 =												118.0528 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3438	1.3404	1.3370	1.3211	1.3181	1.3043	1.3043	1.3017	1.3096	1.3181	1.3241	1.3304 (40)
HLP (average)												1.3211 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1515.9669 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (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	14.1338	12.7552	14.0911	13.5931	14.0145	13.5259	13.9540	13.9932	13.5625	14.0594	13.6492 (61)
Total heat required for water heating calculated for each month											
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (64)
Heat gains from water heating, kWh/month											
55.7936	48.8958	50.6884	44.5184	42.9593	37.4288	35.0383	39.7022	40.0269	46.2109	50.0183	54.1416 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3723	19.8709	16.1601	12.2342	9.1452	7.7208	8.3426	10.8440	14.5548	18.4806	21.5696	22.9941	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.8954	240.3640	234.1432	220.8998	204.1824	188.4704	177.9738	175.5052	181.7260	194.9694	211.6868	227.3988	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	(71)
Water heating gains (Table 5)	74.9914	72.7617	68.1295	61.8311	57.7410	51.9844	47.0945	53.3631	55.5929	62.1114	69.4699	72.7710	(72)
Total internal gains	400.5119	398.2494	383.6856	360.2179	336.3215	313.4284	298.6638	304.9652	317.1266	340.8143	367.9792	388.4167	(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				7.7200	10.6334	0.4400	0.0000	0.7700	27.8120 (74)				
South				5.2200	46.7521	0.4400	0.0000	0.7700	82.6827 (78)				
West				0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)				
Solar gains	114.4872	196.3733	275.6694	358.7815	421.5648	428.2462	408.7474	359.7164	303.7357	218.5913	137.2951	97.9142	(83)
Total gains	514.9991	594.6227	659.3551	718.9995	757.8863	741.6747	707.4112	664.6816	620.8623	559.4057	505.2743	486.3309	(84)

7. Mean internal temperature (heating season)

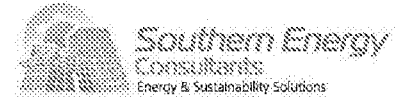
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.4629	41.5696	41.6747	42.1756	42.2706	42.7188	42.7188	42.8029	42.5451	42.2706	42.0788	41.8800
alpha	3.7642	3.7713	3.7783	3.8117	3.8180	3.8479	3.8479	3.8535	3.8363	3.8180	3.8053	3.7920
util living area	0.9955	0.9918	0.9837	0.9623	0.9091	0.7960	0.6517	0.7005	0.8828	0.9721	0.9922	0.9964 (86)
MIT	19.2153	19.3984	19.7025	20.1152	20.5115	20.8125	20.9376	20.9162	20.6876	20.1812	19.6274	19.1864 (87)
Th 2	19.8067	19.8093	19.8120	19.8243	19.8267	19.8375	19.8375	19.8395	19.8333	19.8267	19.8220	19.8171 (88)
util rest of house	0.9943	0.9894	0.9787	0.9492	0.8736	0.7104	0.5101	0.5649	0.8228	0.9599	0.9895	0.9954 (89)
MIT 2	17.4426	17.7110	18.1546	18.7561	19.3070	19.6899	19.8084	19.7960	19.5509	18.8587	18.0543	17.4068 (90)
Living area fraction	17.7144	17.9697	18.3919	18.9645	19.4917	19.8620	19.9815	19.9677	19.7252	19.0615	18.2954	17.6797 (91)
MIT	17.7144	17.9697	18.3919	18.9645	19.4917	19.8620	19.9815	19.9677	19.7252	19.0615	18.2954	17.6797 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5644	17.8197	18.2419	18.8145	19.3417	19.7120	19.8315	19.8177	19.5752	18.9115	18.1454	17.5297 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9903	0.9831	0.9686	0.9334	0.8545	0.6993	0.5093	0.5620	0.8056	0.9458	0.9833	0.9921 (94)
Useful gains	510.0059	584.5839	638.6318	671.1235	647.6476	518.6836	360.2962	373.5320	500.1367	529.0594	496.8556	482.4950 (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	1592.8280	1547.4552	1402.8391	1170.4427	900.1030	595.8193	376.6411	397.5630	640.7577	978.9976	1306.9586	1584.7263 (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	805.6196	647.0495	568.5702	359.5098	187.8268	0.0000	0.0000	0.0000	0.0000	334.7540	583.2742	820.0601 (98)
Space heating												4306.6641 (98)
Space heating per m2												(98) / (4) = 48.1945 (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													4758.7449	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	805.6196	647.0495	568.5702	359.5098	187.8268	0.0000	0.0000	0.0000	0.0000	334.7540	583.2742	820.0601	(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)	890.1874	714.9718	628.2544	397.2484	207.5434	0.0000	0.0000	0.0000	0.0000	369.8939	644.5018	906.1437	(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	171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359	(64)	
Efficiency of water heater (217)m	89.9220	89.8792	89.7916	89.5926	89.1473	87.3000	87.3000	87.3000	87.3000	89.5204	89.8130	89.9440	(217)	
Fuel for water heating, kWh/month	190.5063	167.1354	173.6716	153.2074	148.8304	132.7878	124.6743	140.7526	141.7488	159.1465	171.2645	184.9326	(219)	
Water heating fuel used												1888.6583	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4758.7449	(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)													395.1014	(232)
Total delivered energy for all uses													7117.5046	(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	4758.7449	0.2160	1027.8889 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1888.6583	0.2160	407.9502 (264)
Space and water heating			1435.8391 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	395.1014	0.5190	205.0576 (268)
Total CO2, kg/year			1679.8217 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.8000 (273)

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

DER		18.8000	ZC1
Total Floor Area	TFA	89.3600	
Assumed number of occupants	N	2.6169	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.7757	ZC2
CO2 emissions from cooking, equation (L16)		2.0345	ZC3
Total CO2 emissions		36.6102	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.6102	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1378 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3878 (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) =	0.3296 (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	0.4203	0.4121	0.4038	0.3626	0.3544	0.3132	0.3132	0.3049	0.3296	0.3544	0.3709	0.3873 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5688	0.5750 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			13.5400	1.3258	17.9508		(27)
Heat Loss Floor 1			44.2200	0.1300	5.7486		(28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.1800	21.7476		(29a)
Main Plane	44.2200		44.2200	0.1300	5.7486		(30)
Bay Roof/GRP	1.0000		1.0000	0.1300	0.1300		(30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.0556		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0888 (36)
Total fabric heat loss						(33) + (36) =	67.1444 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.2618	42.0154	41.7739	40.6396	40.4274	39.4395	39.4395	39.2565	39.8200	40.4274	40.8567	41.3056 (38)
Heat transfer coeff	109.4061	109.1598	108.9183	107.7840	107.5717	106.5838	106.5838	106.4009	106.9643	107.5717	108.0011	108.4499 (39)
Average = Sum(39)m / 12 =												107.7830 (39)
HLP	1.2243	1.2216	1.2189	1.2062	1.2038	1.1927	1.1927	1.1907	1.1970	1.2038	1.2086	1.2136 (40)
HLP (average)												1.2062 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)
Energy content (annual)										Total = Sum(45)m =		1515.9669 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (46)	
Water storage loss:												
Total storage loss												

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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 (56)
Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.0811	46.5650	46.1532	42.7637	44.1892	46.1532	46.5650	50.0811	49.3151	50.9589 (61)
Solar input	208.1322	183.4922	191.9325	170.2344	164.8169	145.1616	139.0758	155.0370	156.7492	178.4902	189.4836	203.1729 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	208.1322	183.4922	191.9325	170.2344	164.8169	145.1616	139.0758	155.0370	156.7492	178.4902	189.4836	203.1729 (64)
	64.9999	57.2139	59.6859	52.7613	50.9940	44.7382	42.5971	47.7422	48.2775	55.2163	58.9348	63.3509 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3723	19.8709	16.1601	12.2342	9.1452	7.7208	8.3426	10.8440	14.5548	18.4806	21.5696	22.9941	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.8954	240.3640	234.1432	220.8998	204.1824	188.4704	177.9738	175.5052	181.7260	194.9694	211.6868	227.3988	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	(71)
Water heating gains (Table 5)	87.3654	85.1397	80.2229	73.2796	68.5403	62.1364	57.2542	64.1696	67.0521	74.2154	81.8539	85.1490	(72)
Total internal gains	412.8859	410.6274	395.7790	371.6665	347.1208	323.5805	308.8235	315.7716	328.5858	352.9184	380.3632	400.7948	(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				7.7200	10.6334	0.6300	0.7000	0.7700		25.0877 (74)		
South				5.2200	46.7521	0.6300	0.7000	0.7700		74.5836 (78)		
West				0.6000	19.6403	0.6300	0.7000	0.7700		3.6014 (80)		
Solar gains	103.2727	177.1376	248.6664	323.6373	380.2706	386.2976	368.7087	324.4805	273.9834	197.1793	123.8464	88.3230 (83)
Total gains	516.1586	587.7651	644.4454	695.3038	727.3914	709.8780	677.5322	640.2522	602.5692	550.0977	504.2096	489.1178 (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	56.7204	56.8484	56.9744	57.5740	57.6876	58.2223	58.2223	58.3224	58.0152	57.6876	57.4583	57.2205	
alpha	4.7814	4.7899	4.7983	4.8383	4.8458	4.8815	4.8815	4.8882	4.8677	4.8458	4.8306	4.8147	
util living area	0.9983	0.9965	0.9919	0.9772	0.9310	0.8130	0.6522	0.7035	0.9017	0.9834	0.9966	0.9987	(86)
MIT	19.6397	19.7843	20.0242	20.3500	20.6636	20.8905	20.9718	20.9593	20.7971	20.3987	19.9614	19.6146	(87)
Th 2	19.9006	19.9028	19.9049	19.9151	19.9170	19.9258	19.9258	19.9274	19.9224	19.9170	19.9131	19.9091	(88)
util rest of house	0.9977	0.9953	0.9889	0.9674	0.8987	0.7261	0.5124	0.5676	0.8430	0.9746	0.9951	0.9982	(89)
MIT 2	18.0905	18.3032	18.6541	19.1310	19.5661	19.8461	19.9146	19.9092	19.7471	19.2064	18.5697	18.0597	(90)
Living area fraction	18.3280	18.5302	18.8642	19.3179	19.7343	20.0062	20.0767	20.0702	19.9081	19.3892	18.7830	18.2981	(91)
MIT	18.3280	18.5302	18.8642	19.3179	19.7343	20.0062	20.0767	20.0702	19.9081	19.3892	18.7830	18.2981	(92)
Temperature adjustment													0.0000
adjusted MIT	18.3280	18.5302	18.8642	19.3179	19.7343	20.0062	20.0767	20.0702	19.9081	19.3892	18.7830	18.2981	(93)

8. Space heating requirement

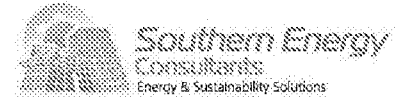
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9964	0.9929	0.9846	0.9601	0.8918	0.7336	0.5335	0.5875	0.8420	0.9684	0.9928	0.9972	(94)
Ext temp.	514.2847	583.5879	634.5219	667.5692	648.7229	520.7713	361.4739	376.1416	507.3575	532.6904	500.5892	487.7393	(95)
Heat loss rate 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	1534.7500	1487.8732	1346.6840	1122.8799	864.2672	576.2141	370.5604	390.5133	621.2588	945.4695	1261.7816	1528.9330	(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	759.2262	607.6797	529.8486	327.8237	160.3649	0.0000	0.0000	0.0000	0.0000	307.1077	548.0585	774.6481	(98)
Space heating per m2												4014.7574	(98)
												44.9279	(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

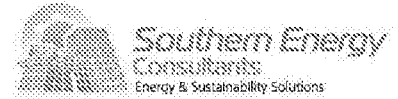
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4298.4554 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	759.2262	607.6797	529.8486	327.8237	160.3649	0.0000	0.0000	0.0000	0.0000	307.1077	548.0585	774.6481	(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)	812.8760	650.6207	567.2897	350.9890	171.6969	0.0000	0.0000	0.0000	0.0000	328.8091	586.7864	829.3877	(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	208.1322	183.4922	191.9325	170.2344	164.8169	145.1616	139.0758	155.0370	156.7492	178.4902	189.4836	203.1729	(64)
Efficiency of water heater (217)m	88.0181	87.8377	87.4743	86.6738	84.9824	80.3000	80.3000	80.3000	80.3000	86.4053	87.5703	88.0976	(216)
Fuel for water heating, kWh/month	236.4654	208.8992	219.4158	196.4081	193.9425	180.7741	173.1953	193.0722	195.2045	206.5732	216.3790	230.6224	(219)
Water heating fuel used												2450.9516	(219)
Annual totals kWh/year													
Space heating fuel - main system												4298.4554	(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)												395.1014	(232)
Total delivered energy for all uses												7219.5084	(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	4298.4554	0.2160	928.4664 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2450.9516	0.2160	529.4055 (264)
Space and water heating			1457.8719 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	395.1014	0.5190	205.0576 (268)
Total CO2, kg/m2/year			1701.8545 (272)
Emissions per m2 for space and water heating			16.3146 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2947 (272b)
Emissions per m2 for pumps and fans			0.4356 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3146 * 1.00) + 2.2947 + 0.4356, rounded to 2 d.p.			19.0400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1378 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3878 (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) =				0.3296 (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	0.4203	0.4121	0.4038	0.3626	0.3544	0.3132	0.3132	0.3049	0.3296	0.3544	0.3709	0.3873 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5688	0.5750 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			9.0000	397.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17526.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							196.1327 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (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	42.2618	42.0154	41.7739	40.6396	40.4274	39.4395	39.4395	39.2565	39.8200	40.4274	40.8567	41.3056 (38)
Heat transfer coeff	118.4912	118.2448	118.0033	116.8690	116.6568	115.6688	115.6688	115.4859	116.0494	116.6568	117.0861	117.5349 (39)
Average = Sum(39)m / 12 =												116.8680 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3260	1.3232	1.3205	1.3078	1.3055	1.2944	1.2944	1.2924	1.2987	1.3055	1.3103	1.3153 (40)
HLP (average)												1.3078 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1515.9669 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.3993	29.2113	30.1434	26.2798	25.2161	21.7595	20.1634	23.1378	23.4141	27.2869	29.7858	32.3455 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3723	19.8709	16.1601	12.2342	9.1452	7.7208	8.3426	10.8440	14.5548	18.4806	21.5696	22.9941	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.8954	240.3640	234.1432	220.8998	204.1824	188.4704	177.9738	175.5052	181.7260	194.9694	211.6868	227.3988	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	(71)
Water heating gains (Table 5)	44.8916	43.4692	40.5153	36.4997	33.8925	30.2216	27.1014	31.0992	32.5196	36.6760	41.3692	43.4751	(72)
Total internal gains	367.4121	365.9569	353.0714	331.8865	309.4730	288.6656	275.6706	279.7013	291.0533	312.3789	336.8785	356.1208	(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					7.7200	10.6334	0.4400	0.0000	0.7700		27.8120 (74)	
South					5.2200	46.7521	0.4400	0.0000	0.7700		82.6827 (78)	
West					0.6000	19.6403	0.4400	0.0000	0.7700		3.9925 (80)	
Solar gains	114.4872	196.3733	275.6694	358.7815	421.5648	428.2462	408.7474	359.7164	303.7357	218.5913	137.2951	97.9142 (83)
Total gains	481.8993	562.3302	628.7409	690.6681	731.0378	716.9119	684.4181	639.4177	594.7890	530.9702	474.1736	454.0350 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.0870	41.1726	41.2569	41.6573	41.7331	42.0896	42.0896	42.1562	41.9515	41.7331	41.5801	41.4213	
alpha	3.7391	3.7448	3.7505	3.7772	3.7822	3.8060	3.8060	3.8104	3.7968	3.7822	3.7720	3.7614	
util living area	0.9961	0.9927	0.9851	0.9647	0.9136	0.8044	0.6623	0.7132	0.8905	0.9748	0.9932	0.9969	(86)
MIT	19.1721	19.3580	19.6670	20.0844	20.4892	20.7992	20.9317	20.9077	20.6675	20.1479	19.5847	19.1396	(87)
Th 2	19.8205	19.8227	19.8248	19.8347	19.8366	19.8452	19.8452	19.8468	19.8419	19.8366	19.8328	19.8289	(88)
util rest of house	0.9951	0.9905	0.9805	0.9525	0.8800	0.7213	0.5218	0.5795	0.8339	0.9639	0.9909	0.9961	(89)
MIT 2	18.1624	18.3491	18.6576	19.0755	19.4619	19.7352	19.8228	19.8130	19.6329	19.1436	18.5834	18.1362	(90)
Living area fraction	fLA = Living area / (4) =												0.1533 (91)
MIT	18.3172	18.5038	18.8123	19.2302	19.6194	19.8983	19.9928	19.9809	19.7915	19.2976	18.7369	18.2901	(92)
Temperature adjustment													0.0000
adjusted MIT	18.3172	18.5038	18.8123	19.2302	19.6194	19.8983	19.9928	19.9809	19.7915	19.2976	18.7369	18.2901	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	478.5420	555.1385	613.0311	652.1420	637.5814	520.3455	370.7870	381.8890	494.1758	508.0779	468.3673	451.4942	(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	1660.9131	1608.5741	1452.8951	1207.2817	923.8468	612.8533	392.4418	413.5382	660.4999	1014.6284	1362.5237	1656.0737	(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	879.6841	707.9087	624.8588	399.7006	212.9814	0.0000	0.0000	0.0000	0.0000	376.8736	643.7926	896.2071	(98)
Space heating													4742.0069 (98)
Space heating per m2	(98) / (4) =												53.0663 (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	1087.2872	855.9495	877.6928	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	0.7294	0.8101	0.7774	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	793.0645	693.3673	682.3474	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	937.0254	897.0023	846.2602	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	103.6518	151.5044	121.9511	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												377.1073 (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	25.9130	37.8761	30.4878	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												94.2768 (107)
Space cooling per m2												1.0550 (108)
Energy for space heating												53.0663 (99)
Energy for space cooling												1.0550 (108)
Total												54.1213 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1378 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3878 (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) =	0.3296 (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	0.4203	0.4121	0.4038	0.3626	0.3544	0.3132	0.3132	0.3049	0.3296	0.3544	0.3709	0.3873 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5688	0.5750 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			13.5400	1.3258	17.9508		(27)
Heat Loss Floor 1			44.2200	0.1300	5.7486		(28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.1800	21.7476		(29a)
Main Plane	44.2200		44.2200	0.1300	5.7486		(30)
Bay Roof/GRP	1.0000		1.0000	0.1300	0.1300		(30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.0556		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0888 (36)
Total fabric heat loss						(33) + (36) =	67.1444 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.2618	42.0154	41.7739	40.6396	40.4274	39.4395	39.4395	39.2565	39.8200	40.4274	40.8567	41.3056 (38)
Heat transfer coeff	109.4061	109.1598	108.9183	107.7840	107.5717	106.5838	106.5838	106.4009	106.9643	107.5717	108.0011	108.4499 (39)
Average = Sum(39)m / 12 =												107.7830 (39)
HLP	1.2243	1.2216	1.2189	1.2062	1.2038	1.1927	1.1927	1.1907	1.1970	1.2038	1.2086	1.2136 (40)
HLP (average)												1.2062 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)
Energy content (annual)										Total = Sum(45)m =		1515.9669 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.3993	29.2113	30.1434	26.2798	25.2161	21.7595	20.1634	23.1378	23.4141	27.2869	29.7858	32.3455 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	130.8429	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3723	19.8709	16.1601	12.2342	9.1452	7.7208	8.3426	10.8440	14.5548	18.4806	21.5696	22.9941	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.8954	240.3640	234.1432	220.8998	204.1824	188.4704	177.9738	175.5052	181.7260	194.9694	211.6868	227.3988	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	36.0843	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	(71)
Water heating gains (Table 5)	44.8916	43.4692	40.5153	36.4997	33.8925	30.2216	27.1014	31.0992	32.5196	36.6760	41.3692	43.4751	(72)
Total internal gains	367.4121	365.9569	353.0714	331.8865	309.4730	288.6656	275.6706	279.7013	291.0533	312.3789	336.8785	356.1208	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.7200	10.6334	0.6300	0.7000	0.7700	25.0877 (74)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836 (78)
West	0.6000	19.6403	0.6300	0.7000	0.7700	3.6014 (80)

Solar gains	103.2727	177.1376	248.6664	323.6373	380.2706	386.2976	368.7087	324.4805	273.9834	197.1793	123.8464	88.3230 (83)
Total gains	470.6848	543.0945	601.7378	655.5238	689.7436	674.9632	644.3794	604.1818	565.0367	509.5582	460.7249	444.4439 (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	56.7204	56.8484	56.9744	57.5740	57.6876	58.2223	58.2223	58.3224	58.0152	57.6876	57.4583	57.2205	
alpha	4.7814	4.7899	4.7983	4.8383	4.8458	4.8815	4.8815	4.8882	4.8677	4.8458	4.8306	4.8147	
util living area	0.9989	0.9975	0.9939	0.9818	0.9422	0.8343	0.6781	0.7328	0.9193	0.9878	0.9977	0.9992	(86)
MIT	19.5929	19.7387	19.9815	20.3128	20.6352	20.8759	20.9666	20.9513	20.7722	20.3595	19.9169	19.5684	(87)
Th 2	19.9006	19.9028	19.9049	19.9151	19.9170	19.9258	19.9258	19.9274	19.9224	19.9170	19.9131	19.9091	(88)
util rest of house	0.9985	0.9966	0.9916	0.9739	0.9137	0.7511	0.5363	0.5968	0.8673	0.9811	0.9967	0.9989	(89)
MIT 2	18.6181	18.7653	19.0088	19.3441	19.6529	19.8625	19.9165	19.9120	19.7841	19.3942	18.9516	18.6003	(90)
Living area fraction									fLA = Living area / (4) =			0.1533	(91)
MIT	18.7675	18.9145	19.1579	19.4926	19.8035	20.0179	20.0775	20.0714	19.9356	19.5422	19.0996	18.7488	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7675	18.9145	19.1579	19.4926	19.8035	20.0179	20.0775	20.0714	19.9356	19.5422	19.0996	18.7488	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	469.6813	540.6331	595.3369	635.6934	627.6464	512.6023	359.6370	372.8963	490.4985	498.2586	458.7109	443.7274	(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	1582.8348	1529.8202	1378.6791	1141.7119	871.7104	577.4603	370.6483	390.6367	624.1965	961.9237	1295.9707	1577.8117	(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	828.1862	664.7337	582.8066	364.3333	181.5836	0.0000	0.0000	0.0000	0.0000	344.9669	602.8270	843.7587	(98)
Space heating												4413.1959	(98)
Space heating per m ²										(98) / (4) =		49.3867	(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	1001.8878	788.7202	808.6465	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7763	0.8595	0.8283	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	777.7917	677.9436	669.8224	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	887.9945	850.2038	805.0754	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)

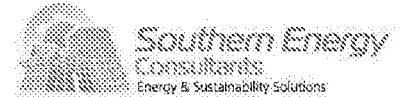


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	79.3460	128.1616	100.6283	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												308.1358 (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	19.8365	32.0404	25.1571	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												77.0340 (107)
Space cooling per m2												0.8621 (108)
Energy for space heating												49.3867 (99)
Energy for space cooling												0.8621 (108)
Total												50.2488 (109)
Target Fabric Energy Efficiency (TFEE)												57.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1838 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4338 (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)	=	0.3687 (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	0.3871	0.3687	0.3687	0.3410	0.3410	0.3042	0.3134	0.2950	0.3042	0.3226	0.3226	0.3503 (22b)
Effective ac	0.5749	0.5680	0.5680	0.5582	0.5582	0.5463	0.5491	0.5435	0.5463	0.5520	0.5520	0.5613 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17924.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.5864 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (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	41.2999	40.7994	40.7994	40.0945	40.0945	39.2401	39.4445	39.0418	39.2401	39.6551	39.6551	40.3234 (38)
Heat transfer coeff	117.5293	117.0288	117.0288	116.3239	116.3239	115.4695	115.6739	115.2712	115.4695	115.8845	115.8845	116.5528 (39)
Average = Sum(39)m / 12 =												116.2034 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3096	1.3096	1.3017	1.3017	1.2922	1.2945	1.2900	1.2922	1.2968	1.2968	1.3043 (40)
HLP (average)												1.3004 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

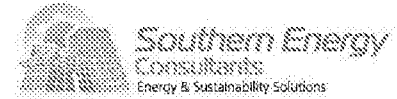
Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1515.9669 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (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	14.1338	12.7552	14.0911	13.5931	14.0145	13.5259	13.9540	13.9932	13.5625	14.0594	13.6492 (61)
Total heat required for water heating calculated for each month											
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
55.7936	48.8958	50.6884	44.5184	42.9593	37.4288	35.0383	39.7022	40.0269	46.2109	50.0183	54.1416 (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	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.9307	49.6771	40.4002	30.5855	22.8630	19.3019	20.8564	27.1100	36.3869	46.2016	53.9241	57.4852 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.0677	358.7522	349.4674	329.7012	304.7498	281.2991	265.6326	261.9481	271.2329	290.9991	315.9504	339.4012 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743 (71)
Water heating gains (Table 5)	74.9914	72.7617	68.1295	61.8311	57.7410	51.9844	47.0945	53.3631	55.5929	62.1114	69.4699	72.7710 (72)
Total internal gains	594.6450	589.8462	566.6523	530.7729	494.0091	461.2406	442.2387	451.0764	471.8679	507.9673	547.9996	578.3125 (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				7.7200	11.9814	0.4400	0.0000	0.7700	31.3379 (74)			
South				5.2200	50.9848	0.4400	0.0000	0.7700	90.1685 (78)			
West				0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (80)			
Solar gains	126.0459	194.8844	271.6585	367.3084	422.9529	460.7841	434.6699	389.4549	325.4488	231.9830	154.9100	106.7343 (83)
Total gains	720.6908	784.7306	838.3107	898.0814	916.9620	922.0247	876.9086	840.5312	797.3167	739.9503	702.9096	685.0468 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.3639	42.5451	42.5451	42.8029	42.8029	43.1196	43.0434	43.1938	43.1196	42.9652	42.9652	42.7188
alpha	3.8243	3.8363	3.8363	3.8535	3.8535	3.8746	3.8696	3.8796	3.8746	3.8643	3.8643	3.8479
util living area	0.9838	0.9763	0.9576	0.9093	0.7998	0.5837	0.4012	0.4286	0.7205	0.9151	0.9713	0.9862 (86)
MIT	19.6052	19.7524	20.0502	20.4276	20.7621	20.9526	20.9919	20.9896	20.8849	20.5023	20.0054	19.5804 (87)
Th 2	19.8289	19.8333	19.8333	19.8395	19.8395	19.8470	19.8452	19.8487	19.8470	19.8433	19.8433	19.8375 (88)
util rest of house	0.9792	0.9697	0.9451	0.8806	0.7342	0.4666	0.2556	0.2795	0.6175	0.8819	0.9618	0.9823 (89)
MIT 2	18.0227	18.2377	18.6644	19.1942	19.6233	19.8222	19.8436	19.8465	19.7686	19.3080	18.6118	17.9928 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2653	18.4699	18.8769	19.3833	19.7979	19.9955	20.0197	20.0218	19.9398	19.4911	18.8255	18.2362 (92)
Temperature adjustment												
adjusted MIT	18.1153	18.3199	18.7269	19.2333	19.6479	19.8455	19.8697	19.8718	19.7898	19.3411	18.6755	18.0862 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9694	0.9575	0.9289	0.8618	0.7216	0.4664	0.2588	0.2826	0.6117	0.8631	0.9481	0.9735 (94)
Useful gains	698.6724	751.4030	778.6782	773.9341	661.6397	430.0726	226.9218	237.5149	487.6924	638.6747	666.4218	666.9065 (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	1529.6815	1488.5990	1325.5679	1085.6805	773.3110	444.0393	227.8394	238.8140	529.9800	897.0769	1237.1212	1513.5827 (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	618.2707	495.3957	406.8859	224.4574	83.0835	0.0000	0.0000	0.0000	0.0000	192.2512	410.9036	629.9271 (98)
Space heating												3061.1751 (98)
RHI space heating demand												3061 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1838 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4338 (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)	=	0.3687 (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	0.4701	0.4609	0.4516	0.4056	0.3963	0.3503	0.3503	0.3410	0.3687	0.3963	0.4148	0.4332 (22b)
Effective ac	0.6105	0.6062	0.6020	0.5822	0.5785	0.5613	0.5613	0.5582	0.5680	0.5785	0.5860	0.5938 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17924.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.5864 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.8539	43.5457	43.2436	41.8247	41.5592	40.3234	40.3234	40.0945	40.7994	41.5592	42.0963	42.6578 (38)
Heat transfer coeff	120.0833	119.7751	119.4730	118.0541	117.7886	116.5528	116.5528	116.3239	117.0288	117.7886	118.3257	118.8872 (39)
Average = Sum(39)m / 12 =												118.0528 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3438	1.3404	1.3370	1.3211	1.3181	1.3043	1.3043	1.3017	1.3096	1.3181	1.3241	1.3304 (40)
HLP (average)												1.3211 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1515.9669 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (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	14.1338	12.7552	14.0911	13.5931	14.0145	13.5259	13.9540	13.9932	13.5625	14.0594	13.6492	14.1219 (61)	
Total heat required for water heating calculated for each month													
	171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
	171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (64)	
								Total per year (kWh/year) = Sum(64)m =					1681.4207 (64)
Heat gains from water heating, kWh/month													
	55.7936	48.8958	50.6884	44.5184	42.9593	37.4288	35.0383	39.7022	40.0269	46.2109	50.0183	54.1416 (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	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.9307	49.6771	40.4002	30.5855	22.8630	19.3019	20.8564	27.1100	36.3869	46.2016	53.9241	57.4852 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.0677	358.7522	349.4674	329.7012	304.7498	281.2991	265.6326	261.9481	271.2329	290.9991	315.9504	339.4012 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743 (71)
Water heating gains (Table 5)	74.9914	72.7617	68.1295	61.8311	57.7410	51.9844	47.0945	53.3631	55.5929	62.1114	69.4699	72.7710 (72)
Total internal gains	594.6450	589.8462	566.6523	530.7729	494.0091	461.2406	442.2387	451.0764	471.8679	507.9673	547.9996	578.3125 (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				7.7200	10.6334	0.4400	0.0000	0.7700	27.8120 (74)			
South				5.2200	46.7521	0.4400	0.0000	0.7700	82.6827 (78)			
West				0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)			
Solar gains	114.4872	196.3733	275.6694	358.7815	421.5648	428.2462	408.7474	359.7164	303.7357	218.5913	137.2951	97.9142 (83)
Total gains	709.1322	786.2195	842.3217	889.5545	915.5739	889.4868	850.9861	810.7928	775.6036	726.5586	685.2947	676.2267 (84)

7. Mean internal temperature (heating season)

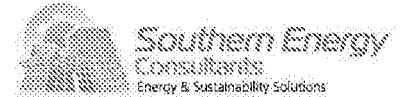
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	41.4629	41.5696	41.6747	42.1756	42.2706	42.7188	42.7188	42.8029	42.5451	42.2706	42.0788	41.8800	
alpha	3.7642	3.7713	3.7783	3.8117	3.8180	3.8479	3.8479	3.8535	3.8363	3.8180	3.8053	3.7920	
util living area	0.9870	0.9796	0.9652	0.9309	0.8569	0.7188	0.5653	0.6078	0.8089	0.9398	0.9788	0.9891	(86)
MIT	19.4392	19.6143	19.8993	20.2788	20.6263	20.8716	20.9617	20.9490	20.7831	20.3483	19.8308	19.4073	(87)
Th 2	19.8067	19.8093	19.8120	19.8243	19.8267	19.8375	19.8375	19.8395	19.8333	19.8267	19.8220	19.8171	(88)
util rest of house	0.9835	0.9741	0.9552	0.9095	0.8097	0.6260	0.4324	0.4765	0.7322	0.9168	0.9721	0.9861	(89)
MIT 2	17.7672	18.0221	18.4340	18.9788	19.4466	19.7428	19.8209	19.8151	19.6516	19.0860	18.3465	17.7277	(90)
Living area fraction	18.0235	18.2662	18.6586	19.1781	19.6275	19.9158	19.9958	19.9890	19.8251	19.2796	18.5740	17.9852	(92)
MIT	17.8735	18.1162	18.5086	19.0281	19.4775	19.7658	19.8458	19.8390	19.6751	19.1296	18.4240	17.8352	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9749	0.9627	0.9401	0.8907	0.7927	0.6195	0.4334	0.4764	0.7198	0.8984	0.9603	0.9785	(94)	
Useful gains	691.3295	756.9195	791.8611	792.3628	725.7502	551.0583	368.8393	386.2690	558.2683	652.7131	658.1075	661.6909	(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	1629.9536	1582.9722	1434.7085	1195.6658	916.0955	602.0920	378.3092	400.0341	652.4433	1004.6848	1339.9244	1621.0502	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	698.3363	555.1074	478.2785	290.3782	141.6169	0.0000	0.0000	0.0000	0.0000	261.8669	490.9081	713.7633	(98)
Space heating												3630.2557	(98)
Space heating per m2												40.6251	(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													4011.3323 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	698.3363	555.1074	478.2785	290.3782	141.6169	0.0000	0.0000	0.0000	0.0000	261.8669	490.9081	713.7633	(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)	771.6423	613.3784	528.4846	320.8599	156.4828	0.0000	0.0000	0.0000	0.0000	289.3557	542.4399	788.6887	(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	171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359	(64)
Efficiency of water heater (217)m	89.8512	89.7990	89.6916	89.4476	88.9234	87.3000	87.3000	87.3000	87.3000	89.3460	89.7154	89.8774	(217)
Fuel for water heating, kWh/month	190.6564	167.2848	173.8652	153.4558	149.2052	132.7878	124.6743	140.7526	141.7488	159.4570	171.4507	185.0698	(219)
Water heating fuel used													1890.4085 (219)
Annual totals kWh/year													
Space heating fuel - main system													4011.3323 (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)													395.1014 (232)
Total delivered energy for all uses													6371.8421 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4011.3323	3.4800	139.5944 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1890.4085	3.4800	65.7862 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	395.1014	13.1900	52.1139 (250)
Additional standing charges			120.0000 (251)
Total energy cost			387.3870 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2109 (257)
SAP value		83.1073
SAP rating (Section 12)		B (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4011.3323	0.2160	866.4478 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1890.4085	0.2160	408.3282 (264)
Space and water heating			1274.7760 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	395.1014	0.5190	205.0576 (268)
Total kg/year			1518.7586 (272)
CO2 emissions per m2			17.0000 (273)
EI value			84.8531
EI rating			B5 (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	$3.48 / 0.8882 = 3.918$, stars = 4
Water heating environmental impact	$0.216 / 0.8882 = 0.2432$, 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	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1838 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4338 (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)	=	0.3687 (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	0.3871	0.3687	0.3687	0.3410	0.3410	0.3042	0.3134	0.2950	0.3042	0.3226	0.3226	0.3503 (22b)
Effective ac	0.5749	0.5680	0.5680	0.5582	0.5582	0.5463	0.5491	0.5435	0.5463	0.5520	0.5520	0.5613 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17924.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.5864 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (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	41.2999	40.7994	40.7994	40.0945	40.0945	39.2401	39.4445	39.0418	39.2401	39.6551	39.6551	40.3234 (38)
Heat transfer coeff	117.5293	117.0288	117.0288	116.3239	116.3239	115.4695	115.6739	115.2712	115.4695	115.8845	115.8845	116.5528 (39)
Average = Sum(39)m / 12 =												116.2034 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3096	1.3096	1.3017	1.3017	1.2922	1.2945	1.2900	1.2922	1.2968	1.2968	1.3043 (40)
HLP (average)												1.3004 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)												Total = Sum(45)m =	1515.9669 (45)
Distribution loss (46)m = 0.15 x (45)m													
23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (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	14.1338	12.7552	14.0911	13.5931	14.0145	13.5259	13.9540	13.9932	13.5625	14.0594	13.6492	14.1219 (61)	
Total heat required for water heating calculated for each month													
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (62)		
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)		
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (64)		
												Total per year (kWh/year) = Sum(64)m =	1681.4207 (64)
Heat gains from water heating, kWh/month													
55.7936	48.8958	50.6884	44.5184	42.9593	37.4288	35.0383	39.7022	40.0269	46.2109	50.0183	54.1416 (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	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.9307	49.6771	40.4002	30.5855	22.8630	19.3019	20.8564	27.1100	36.3869	46.2016	53.9241	57.4852 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.0677	358.7522	349.4674	329.7012	304.7498	281.2991	265.6326	261.9481	271.2329	290.9991	315.9504	339.4012 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743 (71)
Water heating gains (Table 5)	74.9914	72.7617	68.1295	61.8311	57.7410	51.9844	47.0945	53.3631	55.5929	62.1114	69.4699	72.7710 (72)
Total internal gains	594.6450	589.8462	566.6523	530.7729	494.0091	461.2406	442.2387	451.0764	471.8679	507.9673	547.9996	578.3125 (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				7.7200	11.9814		0.4400		0.0000		0.7700		31.3379 (74)
South				5.2200	50.9848		0.4400		0.0000		0.7700		90.1685 (78)
West				0.6000	22.3313		0.4400		0.0000		0.7700		4.5395 (80)
Solar gains	126.0459	194.8844	271.6585	367.3084	422.9529	460.7841	434.6699	389.4549	325.4488	231.9830	154.9100	106.7343	(83)
Total gains	720.6908	784.7306	838.3107	898.0814	916.9620	922.0247	876.9086	840.5312	797.3167	739.9503	702.9096	685.0468	(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	42.3639	42.5451	42.5451	42.8029	42.8029	43.1196	43.0434	43.1938	43.1196	42.9652	42.9652	42.7188	
alpha	3.8243	3.8363	3.8363	3.8535	3.8535	3.8746	3.8696	3.8796	3.8746	3.8643	3.8643	3.8479	
util living area	0.9838	0.9763	0.9576	0.9093	0.7998	0.5837	0.4012	0.4286	0.7205	0.9151	0.9713	0.9862	(86)
MIT	19.6052	19.7524	20.0502	20.4276	20.7621	20.9526	20.9919	20.9896	20.8849	20.5023	20.0054	19.5804	(87)
Th 2	19.8289	19.8333	19.8333	19.8395	19.8395	19.8470	19.8452	19.8487	19.8470	19.8433	19.8433	19.8375	(88)
util rest of house	0.9792	0.9697	0.9451	0.8806	0.7342	0.4666	0.2556	0.2795	0.6175	0.8819	0.9618	0.9823	(89)
MIT 2	18.0227	18.2377	18.6644	19.1942	19.6233	19.8222	19.8436	19.8465	19.7686	19.3080	18.6118	17.9928	(90)
Living area fraction	18.2653	18.4699	18.8769	19.3833	19.7979	19.9955	20.0197	20.0218	19.9398	19.4911	18.8255	18.2362	(92)
MIT	18.1153	18.3199	18.7269	19.2333	19.6479	19.8455	19.8697	19.8718	19.7898	19.3411	18.6755	18.0862	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9694	0.9575	0.9289	0.8618	0.7216	0.4664	0.2588	0.2826	0.6117	0.8631	0.9481	0.9735	(94)	
Useful gains	698.6724	751.4030	778.6782	773.9341	661.6397	430.0726	226.9218	237.5149	487.6924	638.6747	666.4218	666.9065	(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	1529.6815	1488.5990	1325.5679	1085.6805	773.3110	444.0393	227.8394	238.8140	529.9800	897.0769	1237.1212	1513.5827	(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	618.2707	495.3957	406.8859	224.4574	83.0835	0.0000	0.0000	0.0000	0.0000	192.2512	410.9036	629.9271	(98)
Space heating												3061.1751	(98)
Space heating per m2												34.2567	(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													3382.5140 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	618.2707	495.3957	406.8859	224.4574	83.0835	0.0000	0.0000	0.0000	0.0000	192.2512	410.9036	629.9271	(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)	683.1721	547.3986	449.5977	248.0192	91.8050	0.0000	0.0000	0.0000	0.0000	212.4323	454.0371	696.0520	(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	171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359	(64)
Efficiency of water heater (217)m	89.7860	89.7347	89.5901	89.2584	88.5051	87.3000	87.3000	87.3000	87.3000	89.1097	89.6054	89.8123	(217)
Fuel for water heating, kWh/month	190.7950	167.4046	174.0622	153.7810	149.9104	132.7878	124.6743	140.7526	141.7488	159.8799	171.6613	185.2039	(219)
Water heating fuel used												1892.6618	(219)
Annual totals kWh/year													
Space heating fuel - main system												3382.5140	(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)												395.1014	(232)
Total delivered energy for all uses												5745.2771	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3382.5140	3.8700	130.9033 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1892.6618	3.8700	73.2460 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	395.1014	18.9000	74.6742 (250)
Additional standing charges			93.0000 (251)
Total energy cost			385.9985 (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	3382.5140	0.2160	730.6230 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1892.6618	0.2160	408.8149 (264)
Space and water heating			1139.4380 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	395.1014	0.5190	205.0576 (268)
Total kg/year			1383.4206 (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	3382.5140	1.2200	4126.6670 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1892.6618	1.2200	2309.0474 (264)
Space and water heating			6435.7144 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	395.1014	3.0700	1212.9612 (268)
Primary energy kWh/year			7878.9256 (272)
Primary energy kWh/m2/year			88.1706 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 28	-186 kg (13.4%)
U Solar photovoltaic panels	+ 9.9	-£ 345	-947 kg (79.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28	2.08 kg/m²	B 84 B 87
Solar photovoltaic panels	£345	10.59 kg/m²	A 94 A 96
Total Savings	£373	12.67 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)

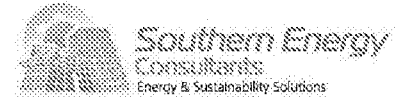
Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£89	£98	-£9
Mains gas	£297	£259	£38
Space heating	£238	£238	£0
Water heating	£73	£45	£28
Lighting	£75	£75	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£386	£12	£374
Total cost of uses	£386	£13	£373
Delivered energy	64 kWh/m²	33 kWh/m²	31 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	13 kg/m²
Primary energy	88 kWh/m²	14 kWh/m²	74 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1838 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4338 (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)	=	0.3687 (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	0.4701	0.4609	0.4516	0.4056	0.3963	0.3503	0.3503	0.3410	0.3687	0.3963	0.4148	0.4332 (22b)
Effective ac	0.6105	0.6062	0.6020	0.5822	0.5785	0.5613	0.5613	0.5582	0.5680	0.5785	0.5860	0.5938 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17924.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.5864 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.8539	43.5457	43.2436	41.8247	41.5592	40.3234	40.3234	40.0945	40.7994	41.5592	42.0963	42.6578 (38)
Heat transfer coeff	120.0833	119.7751	119.4730	118.0541	117.7886	116.5528	116.5528	116.3239	117.0288	117.7886	118.3257	118.8872 (39)
Average = Sum(39)m / 12 =												118.0528 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3438	1.3404	1.3370	1.3211	1.3181	1.3043	1.3043	1.3017	1.3096	1.3181	1.3241	1.3304 (40)
HLP (average)												1.3211 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

Regs Region: England

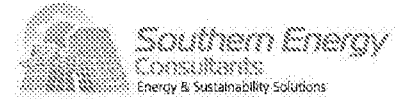
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1515.9669 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (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	14.1338	12.7552	14.0911	13.5931	14.0145	13.5259	13.9540	13.9932	13.5625	14.0594	13.6492 (61)
Total heat required for water heating calculated for each month											
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1079.5246 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1813.6014 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.1963 (H8)
Collector performance factor											0.5665 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											96.3504 (H14)
Solar storage volume factor											0.7784 (H15)
Solar input											0.9499 (H16)
Solar input	-24.8845	-41.5251	-70.7220	-94.7815	-117.0945	-115.1225	-113.6012	-99.2539	-77.7357	-53.0843	-29.5166 (H17)
Output from w/h											
146.4226	108.6949	85.2205	42.4811	15.5838	0.8012	0.0000	23.6231	46.0110	89.3842	124.3011	145.5118 (64)
Heat gains from water heating, kWh/month											
55.7936	48.8958	50.6884	44.5184	42.9593	37.4288	35.0383	39.7022	40.0269	46.2109	50.0183	828.0352 (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	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.9307	49.6771	40.4002	30.5855	22.8630	19.3019	20.8564	27.1100	36.3869	46.2016	53.9241	57.4852	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.0677	358.7522	349.4674	329.7012	304.7498	281.2991	265.6326	261.9481	271.2329	290.9991	315.9504	339.4012	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	(71)
Water heating gains (Table 5)	74.9914	72.7617	68.1295	61.8311	57.7410	51.9844	47.0945	53.3631	55.5929	62.1114	69.4699	72.7710	(72)
Total internal gains	594.6450	589.8462	566.6523	530.7729	494.0091	461.2406	442.2387	451.0764	471.8679	507.9673	547.9996	578.3125	(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	7.7200	10.6334	0.4400	0.0000	0.7700	27.8120 (74)
South	5.2200	46.7521	0.4400	0.0000	0.7700	82.6827 (78)
West	0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)

Solar gains	114.4872	196.3733	275.6694	358.7815	421.5648	428.2462	408.7474	359.7164	303.7357	218.5913	137.2951	97.9142 (83)
Total gains	709.1322	786.2195	842.3217	889.5545	915.5739	889.4868	850.9861	810.7928	775.6036	726.5586	685.2947	676.2267 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	41.4629	41.5696	41.6747	42.1756	42.2706	42.7188	42.7188	42.8029	42.5451	42.2706	42.0788	41.8800
alpha	3.7642	3.7713	3.7783	3.8117	3.8180	3.8479	3.8479	3.8535	3.8363	3.8180	3.8053	3.7920
util living area	0.9870	0.9796	0.9652	0.9309	0.8569	0.7188	0.5653	0.6078	0.8089	0.9398	0.9788	0.9891 (86)
MIT	19.4392	19.6143	19.8993	20.2788	20.6263	20.8716	20.9617	20.9490	20.7831	20.3483	19.8308	19.4073 (87)
Th 2	19.8067	19.8093	19.8120	19.8243	19.8267	19.8375	19.8375	19.8395	19.8333	19.8267	19.8220	19.8171 (88)
util rest of house	0.9835	0.9741	0.9552	0.9095	0.8097	0.6260	0.4324	0.4765	0.7322	0.9168	0.9721	0.9861 (89)
MIT 2	17.7672	18.0221	18.4340	18.9788	19.4466	19.7428	19.8209	19.8151	19.6516	19.0860	18.3465	17.7277 (90)
Living area fraction												0.1533 (91)
MIT	18.0235	18.2662	18.6586	19.1781	19.6275	19.9158	19.9958	19.9890	19.8251	19.2796	18.5740	17.9852 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8735	18.1162	18.5086	19.0281	19.4775	19.7658	19.8458	19.8390	19.6751	19.1296	18.4240	17.8352 (93)

**Southern Energy
Consultants**
Energy & Sustainability Solutions

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9749	0.9627	0.9401	0.8907	0.7927	0.6195	0.4334	0.4764	0.7198	0.8984	0.9603	0.9785 (94)
Useful gains	691.3295	756.9195	791.8611	792.3628	729.7502	551.0583	368.8393	386.2690	558.2683	652.7131	658.1075	661.6909 (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	1629.9536	1582.9722	1434.7085	1195.6658	916.0955	602.0920	378.3092	400.0341	652.4433	1004.6848	1339.9244	1621.0502 (97)
Month fractl	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	698.3363	555.1074	478.2785	290.3782	141.6169	0.0000	0.0000	0.0000	0.0000	261.8669	490.9081	713.7633 (98)
Space heating												3630.2557 (98)
Space heating per m2										(98) / (4) =		40.6251 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4011.3323	(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)		395.1014 (232)
Energy saving/generation technologies (Appendices M, N and Q)		
PV Unit 0 (0.80 * 2.50 * 1050 * 0.80) =	-1727.2394	-1727.2394 (233)
Total delivered energy for all uses		3727.4927 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4011.3323	3.4800	139.5944 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	923.2985	3.4800	32.1308 (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	395.1014	13.1900	52.1139 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			132.5036 (255)

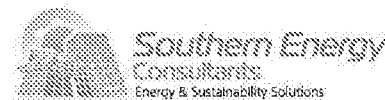
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4142 (257)
SAP value		94.2219
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	4011.3323	0.2160	866.4478 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	923.2985	0.2160	199.4325 (264)
Space and water heating			1065.8802 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	395.1014	0.5190	205.0576 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			439.3756 (272)
CO2 emissions per m2			4.9200 (273)
EI value			95.6180
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2200 (1b)	x 2.3400 (2b)	= 103.4748 (1b) - (3b)
First floor	45.1400 (1c)	x 2.5300 (2c)	= 114.2042 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.6790 (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) = 0.1838 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4338 (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)	=	0.3687 (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	0.3871	0.3687	0.3687	0.3410	0.3410	0.3042	0.3134	0.2950	0.3042	0.3226	0.3226	0.3503 (22b)
Effective ac	0.5749	0.5680	0.5680	0.5582	0.5582	0.5463	0.5491	0.5435	0.5463	0.5520	0.5520	0.5613 (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)			13.5400	1.2357	16.7319		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			44.2200	0.2000	8.8440	75.0000	3316.5000 (28a)
Brick/Render Cavity	138.6600	17.8400	120.8200	0.2500	30.2050	60.0000	7249.2000 (29a)
Main Plane	44.2200		44.2200	0.1100	4.8642	9.0000	397.9800 (30)
Bay Roof/GRP	1.0000		1.0000	0.3000	0.3000	9.0000	9.0000 (30)
Total net area of external elements Aum(A, m ²)			228.1000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3951		(33)
Internal Wall 1			51.8500			75.0000	3888.7500 (32c)
Internal Wall 2			163.4500			9.0000	1471.0500 (32c)
Internal Floor 1			44.2200			18.0000	795.9600 (32d)
Internal Ceiling 1			44.2200			18.0000	795.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17924.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.5864 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8343 (36)
Total fabric heat loss						(33) + (36) =	76.2294 (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	41.2999	40.7994	40.7994	40.0945	40.0945	39.2401	39.4445	39.0418	39.2401	39.6551	39.6551	40.3234 (38)
Heat transfer coeff	117.5293	117.0288	117.0288	116.3239	116.3239	115.4695	115.6739	115.2712	115.4695	115.8845	115.8845	116.5528 (39)
Average = Sum(39)m / 12 =												116.2034 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3096	1.3096	1.3017	1.3017	1.2922	1.2945	1.2900	1.2922	1.2968	1.2968	1.3043 (40)
HLP (average)												1.3004 (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												2.6169 (42)
Average daily hot water use (litres/day)												96.3504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.9854	102.1314	98.2774	94.4234	90.5694	86.7154	86.7154	90.5694	94.4234	98.2774	102.1314	105.9854 (44)
Energy conte	157.1733	137.4648	141.8514	123.6695	118.6638	102.3978	94.8866	108.8838	110.1842	128.4091	140.1686	152.2140 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1515.9669 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.5760	20.6197	21.2777	18.5504	17.7996	15.3597	14.2330	16.3326	16.5276	19.2614	21.0253	22.8321 (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	14.1338	12.7552	14.0911	13.5931	14.0145	13.5259	13.9540	13.9932	13.5625	14.0594	13.6492 (61)
Total heat required for water heating calculated for each month											
171.3071	150.2200	155.9425	137.2625	132.6783	115.9237	108.8407	122.8770	123.7467	142.4685	153.8178	166.3359 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-26.9261	-40.4698	-68.1563	-94.2129	-113.4640	-119.4160	-116.5485	-104.0786	-81.2337	-55.2618	-32.7293 (63)
Output from w/h											
144.3810	109.7502	87.7862	43.0496	19.2143	0.0000	0.0000	18.7985	42.5130	87.2068	121.0884	144.0274 (64)
Heat gains from water heating, kWh/month											
55.7936	48.8958	50.6884	44.5184	42.9593	37.4288	35.0383	39.7022	40.0269	46.2109	50.0183	54.1416 (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	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	157.0115	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.9307	49.6771	40.4002	30.5855	22.8630	19.3019	20.8564	27.1100	36.3869	46.2016	53.9241	57.4852	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.0677	358.7522	349.4674	329.7012	304.7498	281.2991	265.6326	261.9481	271.2329	290.9991	315.9504	339.4012	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	53.3180	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	-104.6743	(71)
Water heating gains (Table 5)	74.9914	72.7617	68.1295	61.8311	57.7410	51.9844	47.0945	53.3631	55.5929	62.1114	69.4699	72.7710	(72)
Total internal gains	594.6450	589.8462	566.6523	530.7729	494.0091	461.2406	442.2387	451.0764	471.8679	507.9673	547.9996	578.3125	(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	7.7200	11.9814	0.4400	0.0000	0.7700	31.3379 (74)
South	5.2200	50.9848	0.4400	0.0000	0.7700	90.1685 (78)
West	0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (80)

Solar gains	126.0459	194.8844	271.6585	367.3084	422.9529	460.7841	434.6699	389.4549	325.4488	231.9830	154.9100	106.7343 (83)
Total gains	720.6908	784.7306	838.3107	898.0814	916.9620	922.0247	876.9086	840.5312	797.3167	739.9503	702.9096	685.0468 (84)

7. Mean internal temperature (heating season)

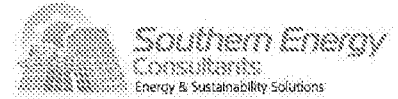
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	42.3639	42.5451	42.5451	42.8029	42.8029	43.1196	43.0434	43.1938	43.1196	42.9652	42.9652	42.7188
alpha	3.8243	3.8363	3.8363	3.8535	3.8535	3.8746	3.8696	3.8796	3.8746	3.8643	3.8643	3.8479
util living area	0.9838	0.9763	0.9576	0.9093	0.7998	0.5837	0.4012	0.4286	0.7205	0.9151	0.9713	0.9862 (86)
MIT	19.6052	19.7524	20.0502	20.4276	20.7621	20.9526	20.9919	20.9896	20.8849	20.5023	20.0054	19.5804 (87)
Th 2	19.8289	19.8333	19.8333	19.8395	19.8395	19.8470	19.8452	19.8487	19.8470	19.8433	19.8433	19.8375 (88)
util rest of house	0.9792	0.9697	0.9451	0.8806	0.7342	0.4666	0.2556	0.2795	0.6175	0.8819	0.9618	0.9823 (89)
MIT 2	18.0227	18.2377	18.6644	19.1942	19.6233	19.8222	19.8436	19.8465	19.7686	19.3080	18.6118	17.9928 (90)
Living area fraction	fLA = Living area / (4) =											0.1533 (91)
MIT	18.2653	18.4699	18.8769	19.3833	19.7979	19.9955	20.0197	20.0218	19.9398	19.4911	18.8255	18.2362 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1153	18.3199	18.7269	19.2333	19.6479	19.8455	19.8697	19.8718	19.7898	19.3411	18.6755	18.0862 (93)

Southern Energy
Consultants
Energy & Sustainability Solutions

elmhurst
energy

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 250.8999 (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	3382.5140	1.2200	4126.6670 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	912.4219	1.2200	1113.1547 (264)
Space and water heating			5239.8217 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	395.1014	3.0700	1212.9612 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1236.3629 (272)
Primary energy kWh/m2/year			13.8358 (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	South
Overshading	Average or unknown
Thermal mass parameter	200.6 (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	287.34 (P1)
Transmission heat loss coefficient	76.23 (37)
Summer heat loss coefficient	363.57 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	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	7.7200	81.1852	0.4400	0.0000	0.9000	248.1928
South	5.2200	112.2060	0.4400	0.0000	0.9000	231.9433
West	0.6000	117.5071	0.4400	0.0000	0.9000	27.9197

total: 508.0558

	Jun	Jul	Aug	
Solar gains	539	508	455	(P4)
Internal gains	458	439	448	
Total summer gains	997	947	903	(P5)

Summer gain/loss ratio	2.74	2.61	2.48	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 200.6)	0.60	0.60	0.60	
Threshold temperature	19.34	21.10	20.88	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight