

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG003c		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Coniston+, Plot 79				
SAP Rating	84 B	DER	16.89	TET	17.39
Environmental	85 B	% DER<TER	2.86		
CO ₂ Emissions (t/year)	1.56	DPEE	51.15	TPEE	55.77
General Requirements Compliance	Pass	% DPEE<TPEE	8.29		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 113 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.89 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.1 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	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

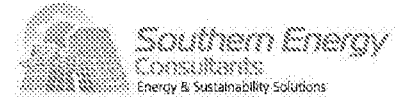
Overshading: Average
Windows facing North East: 8.32 m², No overhang
Windows facing South East: 1.44 m², No overhang
Windows facing South West: 7.24 m², No overhang
Windows facing North West: 0.84 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) =	0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =		0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(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	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(65)
Total per year (kWh/year) = Sum(64)m =												1761.3181	(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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	448.1361	445.7772	429.4474	402.9906	375.7934	349.9149	333.3324	339.9431	353.7467	380.4355	411.0704	434.3637	(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	
Northeast					8.3200	11.2829	0.4400	0.0000	0.7700		31.8045 (75)	
Southeast					1.4400	36.7938	0.4400	0.0000	0.7700		17.9507 (77)	
Southwest					7.2400	36.7938	0.4400	0.0000	0.7700		90.2520 (79)	
Northwest					0.8400	11.2829	0.4400	0.0000	0.7700		3.2110 (81)	

Solar gains	143.2183	255.5845	380.5952	523.3579	633.4687	649.6778	617.7069	532.3809	429.5336	290.8049	173.6606	121.1945 (83)
Total gains	591.3544	701.3616	810.0427	926.3485	1009.2621	999.5926	951.0392	872.3239	783.2802	671.2405	584.7310	555.5581 (84)

7. Mean internal temperature (heating season)

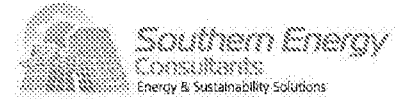
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	43.1362	
alpha	3.8502	3.8568	3.8632	3.8938	3.8996	3.9269	3.9269	3.9320	3.9163	3.8996	3.8879	3.8757	
util living area	0.9964	0.9925	0.9828	0.9537	0.8812	0.7441	0.5930	0.6542	0.8667	0.9725	0.9934	0.9972	(86)
MIT	19.2401	19.4347	19.7622	20.2005	20.5975	20.8624	20.9580	20.9382	20.7254	20.2090	19.6456	19.2077	(87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850	(88)
util rest of house	0.9954	0.9905	0.9778	0.9389	0.8410	0.6576	0.4640	0.5269	0.8056	0.9610	0.9912	0.9964	(89)
MIT 2	17.5287	17.8139	18.2911	18.9257	19.4692	19.7955	19.8825	19.8716	19.6493	18.9481	18.1298	17.4870	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	17.7475	18.0211	18.4791	19.0886	19.6134	19.9319	20.0200	20.0079	19.7869	19.1093	18.3235	17.7069	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5975	17.8711	18.3291	18.9386	19.4634	19.7819	19.8700	19.8579	19.6369	18.9593	18.1735	17.5569	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9920	0.9846	0.9673	0.9216	0.8217	0.6468	0.4599	0.5210	0.7872	0.9467	0.9857	0.9936	(94)
Useful gains	586.6226	690.5547	783.5408	853.7487	829.2683	646.5028	437.4055	454.4397	616.6158	635.4550	576.3540	552.0252	(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	1880.4879	1830.1379	1665.2614	1398.2525	1079.1806	713.6113	450.3173	475.3685	765.2601	1162.0180	1545.5638	1872.1324	(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	962.6358	765.7999	656.0002	392.0427	185.9348	0.0000	0.0000	0.0000	0.0000	391.7628	697.8311	982.1598	(98)
Space heating												5034.1671	(98)
Space heating per m2												(98) / (4) =	44.6806 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5562.6156 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	962.6358	765.7999	656.0002	392.0427	185.9348	0.0000	0.0000	0.0000	0.0000	391.7628	697.8311	982.1598 (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)	1063.6860	846.1877	724.8621	433.1964	205.4528	0.0000	0.0000	0.0000	0.0000	432.8871	771.0840	1085.2594 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (64)
Efficiency of water heater (217)m	89.9814	89.9378	89.8432	89.6185	89.1032	87.3000	87.3000	87.3000	87.3000	89.5941	89.8818	87.3000 (216)
Fuel for water heating, kWh/month	199.5769	175.0738	181.8910	160.4448	155.9301	138.9748	130.4075	147.3327	148.4088	166.5673	179.3440	193.7163 (219)
Water heating fuel used												1977.6680 (219)
Annual totals kWh/year												
Space heating fuel - main system												5562.6156 (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)												453.1995 (232)
Total delivered energy for all uses												8068.4831 (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	5562.6156	0.2160	1201.5250 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1977.6680	0.2160	427.1763 (264)
Space and water heating			1628.7012 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total CO2, kg/year			1902.8368 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8900 (273)

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

DER		16.8900 ZC1
Total Floor Area	TFA	112.6700
Assumed number of occupants	N	2.8299
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		14.4812 ZC2
CO2 emissions from cooking, equation (L16)		1.6590 ZC3
Total CO2 emissions		33.0302 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		33.0302 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =	0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.3258	23.6515		(27)
Heat Loss Floor 1			56.8600	0.1300	7.3918		(28a)
Brick Cavity	149.5100	22.1400	127.3700	0.1800	22.9266		(29a)
Main Plane	55.8100		55.8100	0.1300	7.2553		(30)
Bay Roof	1.5000		1.5000	0.1300	0.1950		(30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.1502		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6831 (36)
Total fabric heat loss						(33) + (36) =	78.8333 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	132.4150	132.0916	131.7746	130.2856	130.0071	128.7103	128.7103	128.4701	129.2098	130.0071	130.5706	131.1598 (39)
Average = Sum(39)m / 12 =												130.2843 (39)
HLP	1.1752	1.1724	1.1696	1.1563	1.1539	1.1424	1.1424	1.1402	1.1468	1.1539	1.1589	1.1641 (40)
HLP (average)												1.1563 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)
Energy content (annual)										Total = Sum(45)m =		1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	50.9589	49.0107	48.5773	45.0098	46.5102	48.5773	49.0107	50.9589	49.3151	50.9589 (61)
Solar input	216.3875	190.7123	200.2608	179.1757	173.4737	152.7859	146.3805	163.1800	164.9822	186.1125	196.8457	211.1677 (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	216.3875	190.7123	200.2608	179.1757	173.4737	152.7859	146.3805	163.1800	164.9822	186.1125	196.8457	211.1677 (64)
	67.7447	59.6146	62.3826	55.5325	53.6724	47.0880	44.8344	50.2497	50.8132	57.6783	61.3827	66.0091 (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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	91.0547	88.7122	83.8476	77.1285	72.1403	65.4000	60.2613	67.5400	70.5739	77.5246	85.2538	88.7220	(72)
Total internal gains	460.5035	458.1488	441.8278	415.2779	387.3979	360.8388	344.2648	351.5555	366.0457	392.8273	423.4483	446.7353	(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
Northeast			8.3200		11.2829		0.6300		0.7000		0.7700		28.6891 (75)
Southeast			1.4400		36.7938		0.6300		0.7000		0.7700		16.1923 (77)
Southwest			7.2400		36.7938		0.6300		0.7000		0.7700		81.4114 (79)
Northwest			0.8400		11.2829		0.6300		0.7000		0.7700		2.8965 (81)
Solar gains	129.1894	230.5488	343.3142	472.0926	571.4176	586.0389	557.1997	480.2317	387.4588	262.3193	156.6497	109.3229	(83)
Total gains	589.6929	688.6976	785.1420	887.3705	958.8155	946.8777	901.4644	831.7872	753.5045	655.1466	580.0980	556.0582	(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	59.0893	59.2340	59.3765	60.0550	60.1837	60.7901	60.7901	60.9037	60.5551	60.1837	59.9239	59.6548	
alpha	4.9393	4.9489	4.9584	5.0037	5.0122	5.0527	5.0527	5.0602	5.0370	5.0122	4.9949	4.9770	
util living area	0.9989	0.9974	0.9928	0.9745	0.9139	0.7717	0.6045	0.6687	0.8960	0.9862	0.9977	0.9992	(86)
MIT	19.6539	19.8048	20.0604	20.4075	20.7228	20.9224	20.9821	20.9710	20.8195	20.4119	19.9713	19.6299	(87)
Th 2	19.9399	19.9422	19.9444	19.9551	19.9571	19.9664	19.9664	19.9681	19.9628	19.9571	19.9530	19.9488	(88)
util rest of house	0.9986	0.9965	0.9901	0.9640	0.8770	0.6824	0.4744	0.5386	0.8366	0.9787	0.9967	0.9989	(89)
MIT 2	18.1387	18.3607	18.7349	19.2419	19.6733	19.9119	19.9595	19.9554	19.8074	19.2553	18.6122	18.1099	(90)
Living area fraction	18.3324	18.5453	18.9043	19.3908	19.8074	20.0410	20.0902	20.0852	19.9368	19.4031	18.7859	18.3042	(92)
MIT	18.3324	18.5453	18.9043	19.3908	19.8074	20.0410	20.0902	20.0852	19.9368	19.4031	18.7859	18.3042	(93)
Temperature adjustment													
adjusted MIT	18.3324	18.5453	18.9043	19.3908	19.8074	20.0410	20.0902	20.0852	19.9368	19.4031	18.7859	18.3042	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9947	0.9861	0.9563	0.8705	0.6896	0.4908	0.5545	0.8347	0.9730	0.9950	0.9982	(94)
Ext temp.	588.3018	685.0453	774.2485	848.6286	834.6578	652.9681	442.4499	461.2627	628.9679	637.4254	577.2194	555.0763	(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	1858.0935	1802.4278	1634.5678	1366.8044	1054.0237	700.3186	449.2262	473.4412	754.1708	1144.4631	1525.8399	1849.8974	(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	944.7251	750.8810	640.0776	373.0866	163.2082	0.0000	0.0000	0.0000	0.0000	377.2361	683.0067	963.3469	(98)
Space heating per m ²												4895.5682	(98)
												43.4505	(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													5241.5077 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	944.7251	750.8810	640.0776	373.0866	163.2082	0.0000	0.0000	0.0000	0.0000	377.2361	683.0067	963.3469	(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)	1011.4829	803.9411	685.3079	399.4503	174.7411	0.0000	0.0000	0.0000	0.0000	403.8930	731.2706	1031.4207	(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	216.3875	190.7123	200.2608	179.1757	173.4737	152.7859	146.3805	163.1800	164.9822	186.1125	196.8457	211.1677	(64)
Efficiency of water heater (217)m	88.3295	88.1542	87.7692	86.8556	84.8980	80.3000	80.3000	80.3000	80.3000	86.7935	87.9258	88.4009	(216)
Fuel for water heating, kWh/month	244.9775	216.3393	228.1675	206.2913	204.3318	190.2689	182.2921	203.2130	205.4572	214.4314	223.8772	238.8750	(219)
Water heating fuel used												2558.5222	(219)
Annual totals kWh/year													
Space heating fuel - main system												5241.5077	(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)												453.1995	(232)
Total delivered energy for all uses												8328.2293	(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	5241.5077	0.2160	1132.1657 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2558.5222	0.2160	552.6408 (264)
Space and water heating			1684.8064 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total CO2, kg/m2/year			1958.9420 (272)
Emissions per m2 for space and water heating			14.9535 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0876 (272b)
Emissions per m2 for pumps and fans			0.3455 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9535 * 1.00) + 2.0876 + 0.3455, rounded to 2 d.p.			17.3900 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			9.0000	502.2900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21263.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.7239 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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	2.8299 (42)
Average daily hot water use (litres/day)	101.4110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (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 = 1595.5903 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.1536	30.7455	31.7266	27.6601	26.5405	22.9024	21.2225	24.3531	24.6439	28.7201	31.3503	34.0444 (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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	47.2494	45.7523	42.6433	38.4167	35.6727	31.8089	28.5248	32.7326	34.2277	38.6023	43.5420	45.7585	(72)
Total internal gains	413.6981	412.1889	397.6236	373.5661	347.9303	324.2477	309.5282	313.7482	326.6996	350.9051	378.7366	400.7719	(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		
Northeast				8.3200	11.2829	0.4400	0.0000	0.7700		31.8045 (75)		
Southeast				1.4400	36.7938	0.4400	0.0000	0.7700		17.9507 (77)		
Southwest				7.2400	36.7938	0.4400	0.0000	0.7700		90.2520 (79)		
Northwest				0.8400	11.2829	0.4400	0.0000	0.7700		3.2110 (81)		
Solar gains	143.2183	255.5845	380.5952	523.3579	633.4687	649.6778	617.7069	532.3809	429.5336	290.8049	173.6606	121.1945 (83)
Total gains	556.9164	667.7734	778.2188	896.9240	981.3990	973.9255	927.2351	846.1290	756.2331	641.7100	552.3971	521.9663 (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	41.7667	41.8625	41.9567	42.4052	42.4902	42.8903	42.8903	42.9653	42.7353	42.4902	42.3187	42.1408	
alpha	3.7844	3.7908	3.7971	3.8270	3.8327	3.8594	3.8594	3.8644	3.8490	3.8327	3.8212	3.8094	
util living area	0.9968	0.9932	0.9839	0.9561	0.8862	0.7528	0.6033	0.6665	0.8745	0.9748	0.9941	0.9975	(86)
MIT	19.1756	19.3747	19.7102	20.1604	20.5707	20.8493	20.9527	20.9303	20.7029	20.1678	19.5902	19.1432	(87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850	(88)
util rest of house	0.9959	0.9913	0.9792	0.9421	0.8476	0.6678	0.4739	0.5396	0.8162	0.9643	0.9922	0.9968	(89)
MIT 2	18.2117	18.4117	18.7465	19.1955	19.5815	19.8210	19.8867	19.8783	19.7115	19.2102	18.6354	18.1861	(90)
Living area fraction	18.3349	18.5348	18.8697	19.3188	19.7079	19.9525	20.0229	20.0128	19.8382	19.3326	18.7574	18.3084	(92)
Temperature adjustment	18.3349	18.5348	18.8697	19.3188	19.7079	19.9525	20.0229	20.0128	19.8382	19.3326	18.7574	18.3084	(93)
adjusted MIT	18.3349	18.5348	18.8697	19.3188	19.7079	19.9525	20.0229	20.0128	19.8382	19.3326	18.7574	18.3084	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9941	0.9881	0.9735	0.9328	0.8398	0.6722	0.4893	0.5535	0.8122	0.9571	0.9893	0.9954	(94)
Ext temp.	553.6427	659.8261	757.5682	836.6950	824.2182	654.6505	453.6931	468.3629	614.2252	614.1646	546.4848	519.5583	(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	1984.7779	1923.7837	1741.3626	1451.2141	1113.1737	737.0992	471.3768	496.6582	793.0839	1213.9104	1627.0604	1977.4589	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1064.7646	849.3795	731.9430	442.4537	214.9829	0.0000	0.0000	0.0000	0.0000	446.2109	778.0144	1084.6780	(98)
Space heating per m2												5612.4271	(98)
												49.8130	(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													

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	1294.4968	1019.0719	1044.7893	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7802	0.8517	0.8146	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1009.9556	867.9869	851.0741	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1250.2937	1193.2918	1100.6767	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	173.0435	242.0269	185.7043	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			600.7746 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	43.2609	60.5067	46.4261	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												150.1937 (107)
Energy for space heating												1.3330 (108)
Energy for space cooling												49.8130 (99)
Total												1.3330 (108)
Dwelling Fabric Energy Efficiency (DFEE)												51.1460 (109)
												51.1 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =	0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.3258	23.6515		(27)
Heat Loss Floor 1			56.8600	0.1300	7.3918		(28a)
Brick Cavity	149.5100	22.1400	127.3700	0.1800	22.9266		(29a)
Main Plane	55.8100		55.8100	0.1300	7.2553		(30)
Bay Roof	1.5000		1.5000	0.1300	0.1950		(30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.1502		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6831 (36)
Total fabric heat loss						(33) + (36) =	78.8333 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	132.4150	132.0916	131.7746	130.2856	130.0071	128.7103	128.7103	128.4701	129.2098	130.0071	130.5706	131.1598 (39)
Average = Sum(39)m / 12 =												130.2843 (39)
HLP	1.1752	1.1724	1.1696	1.1563	1.1539	1.1424	1.1424	1.1402	1.1468	1.1539	1.1589	1.1641 (40)
HLP (average)												1.1563 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)
Energy content (annual)										Total = Sum(45)m =		1595.5903 (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												

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.1536	30.7455	31.7266	27.6601	26.5405	22.9024	21.2225	24.3531	24.6439	28.7201	31.3503	34.0444 (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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	47.2494	45.7523	42.6433	38.4167	35.6727	31.8089	28.5248	32.7326	34.2277	38.6023	43.5420	45.7585	(72)
Total internal gains	413.6981	412.1889	397.6236	373.5661	347.9303	324.2477	309.5282	313.7482	326.6996	350.9051	378.7366	400.7719	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.3200	11.2829	0.6300	0.7000	0.7700	28.6891 (75)
Southeast	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)
Southwest	7.2400	36.7938	0.6300	0.7000	0.7700	81.4114 (79)
Northwest	0.8400	11.2829	0.6300	0.7000	0.7700	2.8965 (81)

Solar gains	129.1894	230.5488	343.3142	472.0926	571.4176	586.0389	557.1997	480.2317	387.4588	262.3193	156.6497	109.3229	(83)
Total gains	542.8875	642.7377	740.9378	845.6588	919.3479	910.2866	866.7279	793.9799	714.1584	613.2244	535.3863	510.0948	(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	59.0893	59.2340	59.3765	60.0550	60.1837	60.7901	60.7901	60.9037	60.5551	60.1837	59.9239	59.6548	
alpha	4.9393	4.9489	4.9584	5.0037	5.0122	5.0527	5.0527	5.0602	5.0370	5.0122	4.9949	4.9770	
util living area	0.9993	0.9981	0.9944	0.9790	0.9248	0.7905	0.6249	0.6930	0.9118	0.9895	0.9984	0.9995	(86)
MIT	19.6153	19.7671	20.0249	20.3767	20.7011	20.9130	20.9793	20.9660	20.7995	20.3792	19.9345	19.5919	(87)
Th 2	19.9399	19.9422	19.9444	19.9551	19.9571	19.9664	19.9664	19.9681	19.9628	19.9571	19.9530	19.9488	(88)
util rest of house	0.9990	0.9975	0.9922	0.9700	0.8911	0.7029	0.4923	0.5616	0.8579	0.9837	0.9977	0.9993	(89)
MIT 2	18.6715	18.8249	19.0836	19.4389	19.7453	19.9239	19.9609	19.9577	19.8420	19.4463	19.0010	18.6552	(90)
Living area fraction									fLA = Living area / (4) =			0.1278	(91)
MIT	18.7921	18.9453	19.2039	19.5587	19.8674	20.0503	20.0910	20.0866	19.9644	19.5655	19.1203	18.7749	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7921	18.9453	19.2039	19.5587	19.8674	20.0503	20.0910	20.0866	19.9644	19.5655	19.1203	18.7749	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9966	0.9901	0.9656	0.8875	0.7109	0.5092	0.5781	0.8580	0.9806	0.9969	0.9990	(94)
Ext temp.	542.1254	640.5207	733.6243	816.5331	815.9509	647.1408	441.3539	458.9849	612.7810	601.3529	533.7454	509.5730	(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	1918.9766	1855.2671	1674.0480	1388.6800	1061.8255	701.5143	449.3310	473.6136	757.7359	1165.5794	1569.4926	1911.6471	(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	1024.3773	816.3096	699.6752	411.9457	182.9306	0.0000	0.0000	0.0000	0.0000	419.7845	745.7380	1043.1431	(98)
Space heating per m2										(98) / (4) =		47.4297	(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	1209.8764	952.4559	976.3728	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8227	0.8952	0.8601	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	995.3337	852.6102	839.7585	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9106	1122.5691	1039.7231	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)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	130.0153	200.8494	148.7737	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												479.6384 (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	32.5038	50.2124	37.1934	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												119.9096 (107)
Space cooling per m2												1.0643 (108)
Energy for space heating												47.4297 (99)
Energy for space cooling												1.0643 (108)
Total												48.4940 (109)
Target Fabric Energy Efficiency (TFEE)												55.8 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.3533	0.3365	0.3365	0.3112	0.3112	0.2776	0.2860	0.2692	0.2776	0.2944	0.2944	0.3196 (22b)
Effective ac	0.5624	0.5566	0.5566	0.5484	0.5484	0.5385	0.5409	0.5362	0.5385	0.5433	0.5433	0.5511 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	50.9016	50.3764	50.3764	49.6368	49.6368	48.7402	48.9548	48.5321	48.7402	49.1757	49.1757	49.8769 (38)
Heat transfer coeff	138.7371	138.2119	138.2119	137.4723	137.4723	136.5757	136.7903	136.3676	136.5757	137.0112	137.0112	137.7124 (39)
Average = Sum(39)m / 12 =												137.3458 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2314	1.2267	1.2267	1.2201	1.2201	1.2122	1.2141	1.2103	1.2122	1.2160	1.2160	1.2223 (40)
HLP (average)												1.2190 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (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 =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(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	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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	
Northeast					8.3200	12.9236	0.4400	0.0000	0.7700		36.4291 (75)	
Southeast					1.4400	40.4699	0.4400	0.0000	0.7700		19.7441 (77)	
Southwest					7.2400	40.4699	0.4400	0.0000	0.7700		99.2691 (79)	
Northwest					0.8400	12.9236	0.4400	0.0000	0.7700		3.6779 (81)	
Solar gains	159.1204	256.2181	378.7919	539.7555	638.4666	701.3735	659.4229	579.9578	464.4623	311.8079	197.8029	133.2692 (83)
Total gains	827.3228	919.1650	1015.4782	1135.6807	1192.3500	1217.9707	1154.5238	1084.5661	992.8050	881.1437	812.6183	782.7855 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	43.9035
alpha	3.9053	3.9163	3.9163	3.9320	3.9320	3.9513	3.9466	3.9558	3.9513	3.9419	3.9419	3.9269
util living area	0.9863	0.9785	0.9567	0.8956	0.7638	0.5341	0.3628	0.3957	0.6997	0.9165	0.9748	0.9886 (86)
MIT	19.6128	19.7720	20.0926	20.4909	20.8109	20.9676	20.9948	20.9928	20.9023	20.5189	20.0096	19.5842 (87)
Th 2	19.8950	19.8987	19.8987	19.9039	19.9039	19.9103	19.9088	19.9117	19.9103	19.9072	19.9072	19.9022 (88)
util rest of house	0.9826	0.9727	0.9445	0.8657	0.6980	0.4288	0.2374	0.2645	0.6015	0.8853	0.9668	0.9855 (89)
MIT 2	18.0828	18.3151	18.7743	19.3293	19.7327	19.8930	19.9077	19.9101	19.8425	19.3819	18.6666	18.0464 (90)
Living area fraction	18.2783	18.5013	18.9428	19.4777	19.8705	20.0304	20.0466	20.0485	19.9780	19.5272	18.8383	18.278 (91)
MIT	18.2783	18.5013	18.9428	19.4777	19.8705	20.0304	20.0466	20.0485	19.9780	19.5272	18.8383	18.2429 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1283	18.3513	18.7928	19.3277	19.7205	19.8804	19.8966	19.8985	19.8280	19.3772	18.6883	18.0929 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	805.6496	883.3446	942.3058	961.0534	817.2962	518.6055	272.4136	285.0804	588.8796	762.7604	775.0858	765.3541	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1807.5144	1762.3815	1574.6210	1296.0522	923.8763	529.9653	273.1194	286.1648	632.0666	1065.5699	1464.4107	1789.2866	(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	745.3874	590.7128	470.4426	241.1992	79.2956	0.0000	0.0000	0.0000	0.0000	225.2902	496.3140	761.8057	(98)
Space heating												3610.4475	(98)
RHI space heating demand												3610	(98)

FULL SAP CALCULATION PRINTOUT

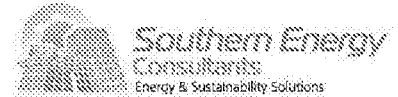
Calculation Type: New Build (As Designed)



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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =				0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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	2.8299 (42)
Average daily hot water use (litres/day)	101.4110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (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 =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(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	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(65)
Total per year (kWh/year) = Sum(64)m =												1761.3181	(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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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	
Northeast				8.3200	11.2829	0.4400		0.0000		0.7700		31.8045 (75)	
Southeast				1.4400	36.7938	0.4400		0.0000		0.7700		17.9507 (77)	
Southwest				7.2400	36.7938	0.4400		0.0000		0.7700		90.2520 (79)	
Northwest				0.8400	11.2829	0.4400		0.0000		0.7700		3.2110 (81)	
Solar gains	143.2183	255.5845	380.5952	523.3579	633.4687	649.6778	617.7069	532.3809	429.5336	290.8049	173.6606	121.1945	(83)
Total gains	811.4207	918.5314	1017.2815	1119.2831	1187.3521	1166.2750	1112.8078	1036.9891	957.8763	860.1407	788.4760	770.7107	(84)

7. Mean internal temperature (heating season)

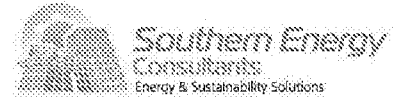
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	43.1362	
alpha	3.8502	3.8568	3.8632	3.8938	3.8996	3.9269	3.9269	3.9320	3.9163	3.8996	3.8879	3.8757	
util living area	0.9892	0.9816	0.9648	0.9211	0.8283	0.6736	0.5205	0.5725	0.7948	0.9420	0.9819	0.9911	(86)
MIT	19.4520	19.6389	19.9464	20.3476	20.6914	20.9042	20.9733	20.9613	20.8079	20.3661	19.8382	19.4165	(87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850	(88)
util rest of house	0.9864	0.9769	0.9552	0.8987	0.7790	0.5847	0.4014	0.4520	0.7203	0.9208	0.9763	0.9888	(89)
MIT 2	17.8367	18.1088	18.5527	19.1244	19.5805	19.8316	19.8904	19.8850	19.7355	19.1628	18.4074	17.7910	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	18.0431	18.3043	18.7308	19.2807	19.7225	19.9687	20.0288	20.0225	19.8726	19.3166	18.5903	17.9987	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8931	18.1543	18.5808	19.1307	19.5725	19.8187	19.8788	19.8725	19.7226	19.1666	18.4403	17.8487	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9788	0.9661	0.9399	0.8792	0.7622	0.5773	0.3987	0.4483	0.7062	0.9020	0.9654	0.9822	(94)
Useful gains	794.2193	887.4299	956.1147	984.0228	905.0421	673.2997	443.6658	464.9077	676.4568	775.8434	761.2241	756.9739	(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	1922.3036	1870.1028	1700.7001	1425.0183	1094.3436	718.6802	451.5267	477.3756	777.1050	1190.8357	1582.7902	1913.0322	(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	839.2947	660.3562	553.9715	317.5167	140.8403	0.0000	0.0000	0.0000	0.0000	308.7542	591.5277	860.1073	(98)
Space heating												4272.3687	(98)
Space heating per m2												(98) / (4) =	37.9193 (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												4720.8494 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	839.2947	660.3562	553.9715	317.5167	140.8403	0.0000	0.0000	0.0000	0.0000	308.7542	591.5277	860.1073 (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)	927.3975	729.6754	612.1232	350.8472	155.6247	0.0000	0.0000	0.0000	0.0000	341.1649	653.6217	950.3949 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (64)
Efficiency of water heater (217)m	89.9191	89.8658	89.7506	89.4777	88.8821	87.3000	87.3000	87.3000	87.3000	89.4318	89.7951	87.3000 (216)
Fuel for water heating, kWh/month	199.7154	175.2140	182.0787	160.6973	156.3180	138.9748	130.4075	147.3327	148.4088	166.8695	179.5170	193.8419 (219)
Water heating fuel used												1979.3756 (219)
Annual totals kWh/year												
Space heating fuel - main system												4720.8494 (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)												453.1995 (232)
Total delivered energy for all uses												7228.4246 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4720.8494	3.4800	164.2856 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1979.3756	3.4800	68.8823 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	453.1995	13.1900	59.7770 (250)
Additional standing charges			120.0000 (251)
Total energy cost			422.8373 (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] =	1.1264 (257)
SAP value		84.2874
SAP rating (Section 12)		84 (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	4720.8494	0.2160	1019.7035 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.3756	0.2160	427.5451 (264)
Space and water heating			1447.2486 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1721.3842 (272)
CO2 emissions per m2			15.2800 (273)
EI value			85.3704
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8886 = 3.916$, stars = 4
Water heating environmental impact	$0.216 / 0.8886 = 0.2431$, stars = 4

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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =				0.3365 (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	0.3533	0.3365	0.3365	0.3112	0.3112	0.2776	0.2860	0.2692	0.2776	0.2944	0.2944	0.3196 (22b)
Effective ac	0.5624	0.5566	0.5566	0.5484	0.5484	0.5385	0.5409	0.5362	0.5385	0.5433	0.5433	0.5511 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	50.9016	50.3764	50.3764	49.6368	49.6368	48.7402	48.9548	48.5321	48.7402	49.1757	49.1757	49.8769 (38)
Heat transfer coeff	138.7371	138.2119	138.2119	137.4723	137.4723	136.5757	136.7903	136.3676	136.5757	137.0112	137.0112	137.7124 (39)
Average = Sum(39)m / 12 =												137.3458 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2314	1.2267	1.2267	1.2201	1.2201	1.2122	1.2141	1.2103	1.2122	1.2160	1.2160	1.2223 (40)
HLP (average)												1.2190 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (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 =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(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	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Total per year (kWh/year) = Sum(64)m =												1761.3181	(64)
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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	
Northeast				8.3200	12.9236	0.4400	0.0000		0.7700		36.4291 (75)	
Southeast				1.4400	40.4699	0.4400	0.0000		0.7700		19.7441 (77)	
Southwest				7.2400	40.4699	0.4400	0.0000		0.7700		99.2691 (79)	
Northwest				0.8400	12.9236	0.4400	0.0000		0.7700		3.6779 (81)	

Solar gains	159.1204	256.2181	378.7919	539.7555	638.4666	701.3735	659.4229	579.9578	464.4623	311.8079	197.8029	133.2692 (83)
Total gains	827.3228	919.1650	1015.4782	1135.6807	1192.3500	1217.9707	1154.5238	1084.5661	992.8050	881.1437	812.6183	782.7855 (84)

7. Mean internal temperature (heating season)

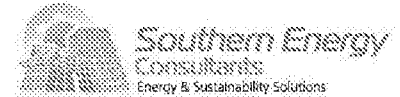
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	43.9035	
alpha	3.9053	3.9163	3.9163	3.9320	3.9320	3.9513	3.9466	3.9558	3.9513	3.9419	3.9419	3.9269	
util living area	0.9863	0.9785	0.9567	0.8956	0.7638	0.5341	0.3628	0.3957	0.6997	0.9165	0.9748	0.9886	(86)
MIT	19.6128	19.7720	20.0926	20.4909	20.8109	20.9676	20.9948	20.9928	20.9023	20.5189	20.0096	19.5842	(87)
Th 2	19.8950	19.8987	19.8987	19.9039	19.9039	19.9103	19.9088	19.9117	19.9103	19.9072	19.9072	19.9022	(88)
util rest of house	0.9826	0.9727	0.9445	0.8657	0.6980	0.4288	0.2374	0.2645	0.6015	0.8853	0.9668	0.9855	(89)
MIT 2	18.0828	18.3151	18.7743	19.3293	19.7327	19.8930	19.9077	19.9101	19.8425	19.3819	18.6666	18.0464	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	18.2783	18.5013	18.9428	19.4777	19.8705	20.0304	20.0466	20.0485	19.9780	19.5272	18.8383	18.2429	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1283	18.3513	18.7928	19.3277	19.7205	19.8804	19.8966	19.8985	19.8280	19.3772	18.6883	18.0929	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9738	0.9610	0.9279	0.8462	0.6854	0.4258	0.2360	0.2629	0.5931	0.8656	0.9538	0.9777	(94)
Useful gains	805.6496	883.3446	942.3058	961.0534	817.2962	518.6055	272.4136	285.0804	588.8796	762.7604	775.0858	765.3541	(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	1807.5144	1762.3815	1574.6210	1296.0522	923.8763	529.9653	273.1194	286.1648	632.0666	1065.5699	1464.4107	1789.2866	(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	745.3874	590.7128	470.4426	241.1992	79.2956	0.0000	0.0000	0.0000	0.0000	225.2902	496.3140	761.8057	(98)
Space heating												3610.4475	(98)
Space heating per m2												(98) / (4) =	32.0444 (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													3989.4448 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.3874	590.7128	470.4426	241.1992	79.2956	0.0000	0.0000	0.0000	0.0000	225.2902	496.3140	761.8057	(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)	823.6325	652.7213	519.8260	266.5184	87.6195	0.0000	0.0000	0.0000	0.0000	248.9395	548.4132	841.7743	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Efficiency of water heater (217)m	89.8605	89.8072	89.6528	89.2778	88.4362	87.3000	87.3000	87.3000	87.3000	89.1972	89.6940	87.3000	(216)
Fuel for water heating, kWh/month	199.8455	175.3283	182.2774	161.0572	157.1061	138.9748	130.4075	147.3327	148.4088	167.3085	179.7195	193.9669	(219)
Water heating fuel used												1981.7331	(219)
Annual totals kWh/year													
Space heating fuel - main system												3989.4448	(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)												453.1995	(232)
Total delivered energy for all uses												6499.3774	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3989.4448	3.8700	154.3915 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1981.7331	3.8700	76.6931 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	453.1995	18.9000	85.6547 (250)
Additional standing charges			93.0000 (251)
Total energy cost			423.9143 (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	3989.4448	0.2160	861.7201 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.7331	0.2160	428.0543 (264)
Space and water heating			1289.7744 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1563.9100 (272)

13a. Primary energy - Individual heating systems including micro-CHP

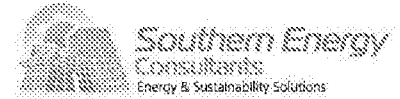
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3989.4448	1.2200	4867.1226 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.7331	1.2200	2417.7144 (264)
Space and water heating			7284.8370 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	453.1995	3.0700	1391.3225 (268)
Primary energy kWh/year			8906.4095 (272)
Primary energy kWh/m2/year			79.0486 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
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	+ 1.0	-£ 30	-192 kg (12.3%)
U Solar photovoltaic panels	+ 8.5	-£ 345	-947 kg (69.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	1.70 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	8.40 kg/m²	A 94 A 95
Total Savings	£374	10.11 kg/m²	

Potential energy efficiency rating: A 94
 Potential environmental impact rating: A 95

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	£100	£109	-£9
Mains gas	£324	£285	£39
Space heating	£262	£262	£0
Water heating	£77	£47	£30
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£424	£49	£375
Total cost of uses	£425	£50	£375
Delivered energy	58 kWh/m²	33 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.6 tonnes	0.4 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	4 kg/m²	10 kg/m²
Primary energy	79 kWh/m²	20 kWh/m²	59 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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) = 0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss							(33) + (36) = 87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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	2.8299 (42)
Average daily hot water use (litres/day)	101.4110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (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 =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411 (61)	
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1079.5246 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1813.6014 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.1366 (H8)	
Utilisation factor												0.5851 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												101.4110 (H14)	
Volume ratio Veff/V												0.7396 (H15)	
Solar storage volume factor												0.9397 (H16)	
Solar input												-876.7982 (H17)	
Solar input	-25.4254	-42.4277	-72.2592	-96.8416	-119.6396	-117.6248	-116.0703	-101.4112	-79.4253	-54.2382	-30.1582	-21.2767 (63)	
	Solar input (sum of months) = Sum(63)m =											-876.7982 (63)	
Output from w/h	154.1568	115.0297	91.1575	46.9467	19.2991	3.7002	0.0000	27.2102	50.1355	94.9963	131.0394	153.0731 (64)	
	Total per year (kWh/year) = Sum(64)m =											886.7445 (64)	
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047 (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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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
Northeast	8.3200	11.2829	0.4400	0.0000	0.7700	31.8045 (75)
Southeast	1.4400	36.7938	0.4400	0.0000	0.7700	17.9507 (77)
Southwest	7.2400	36.7938	0.4400	0.0000	0.7700	90.2520 (79)
Northwest	0.8400	11.2829	0.4400	0.0000	0.7700	3.2110 (81)

Solar gains	143.2183	255.5845	380.5952	523.3579	633.4687	649.6778	617.7069	532.3809	429.5336	290.8049	173.6606	121.1945	(83)
Total gains	811.4207	918.5314	1017.2815	1119.2831	1187.3521	1166.2750	1112.8078	1036.9891	957.8763	860.1407	788.4760	770.7107	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9a, 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	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	43.1362
alpha	3.8502	3.8568	3.8632	3.8938	3.8996	3.9269	3.9269	3.9320	3.9163	3.8996	3.8879	3.8757
util living area	0.9892	0.9816	0.9648	0.9211	0.8283	0.6736	0.5205	0.5725	0.7948	0.9420	0.9819	0.9911 (86)
MIT	19.4520	19.6389	19.9464	20.3476	20.6914	20.9042	20.9733	20.9613	20.8079	20.3661	19.8382	19.4165 (87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850 (88)
util rest of house	0.9864	0.9769	0.9552	0.8987	0.7790	0.5847	0.4014	0.4520	0.7203	0.9208	0.9763	0.9888 (89)
MIT 2	17.8367	18.1088	18.5527	19.1244	19.5805	19.8316	19.8904	19.8850	19.7355	19.1628	18.4074	17.7910 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.0431	18.3043	18.7308	19.2807	19.7225	19.9687	20.0288	20.0225	19.8726	19.3166	18.5903	17.9987 (91)
Temperature adjustment	-0.1500											
adjusted MIT	17.8931	18.1543	18.5808	19.1307	19.5725	19.8187	19.8788	19.8725	19.7226	19.1666	18.4403	17.8487 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Calculation of Energy Ratings for Improved Dwelling 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9661	0.9399	0.8792	0.7622	0.5773	0.3987	0.4483	0.7062	0.9020	0.9654	0.9822	(94)
Useful gains	794.2193	887.4299	956.1147	984.0228	905.0421	673.2997	443.6658	464.9077	676.4568	775.8434	761.2241	756.9739	(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	1922.3036	1870.1028	1700.7001	1425.0183	1094.3436	718.6802	451.5267	477.3756	777.1050	1190.8357	1582.7902	1913.0322	(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	839.2947	660.3562	553.9715	317.5167	140.8403	0.0000	0.0000	0.0000	0.0000	308.7542	591.5277	860.1073	(98)
Space heating												4272.3687	(98)
Space heating per m2											(98) / (4) =	37.9193	(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													4720.8494 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	839.2947	660.3562	553.9715	317.5167	140.8403	0.0000	0.0000	0.0000	0.0000	308.7542	591.5277	860.1073	(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)	927.3975	729.6754	612.1232	350.8472	155.6247	0.0000	0.0000	0.0000	0.0000	341.1649	653.6217	950.3949	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	154.1568	115.0297	91.1575	46.9467	19.2991	3.7002	0.0000	27.2102	50.1355	94.9963	131.0394	153.0731	(64)
Efficiency of water heater	89.9882	90.0105	90.0337	90.0747	90.1020	87.3000	87.3000	87.3000	87.3000	89.7262	89.9024	87.3000	(216)
(217)m	89.9882	90.0105	90.0337	90.0747	90.1020	87.3000	87.3000	87.3000	87.3000	89.7262	89.9024	90.0016	(217)
Fuel for water heating, kWh/month	171.3078	127.7959	101.2483	52.1197	21.4192	4.2385	0.0000	31.1687	57.4290	105.8736	145.7574	170.0782	(219)
Water heating fuel used												988.4362	(219)
Annual totals kWh/year													
Space heating fuel - main system												4720.8494	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												453.1995	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												4560.2458	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4720.8494	3.4800	164.2856	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	988.4362	3.4800	34.3976	(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	453.1995	13.1900	59.7770	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			167.1248	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.4452 (257)
SAP value			93.7897
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	4720.8494	0.2160	1019.7035 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	988.4362	0.2160	213.5022 (264)
Space and water heating			1233.2057 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			636.8540 (272)
CO2 emissions per m2			5.6500 (273)
EI value			94.5875
EI rating			95 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.3533	0.3365	0.3365	0.3112	0.3112	0.2776	0.2860	0.2692	0.2776	0.2944	0.2944	0.3196 (22b)
Effective ac	0.5624	0.5566	0.5566	0.5484	0.5484	0.5385	0.5409	0.5362	0.5385	0.5433	0.5433	0.5511 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	50.9016	50.3764	50.3764	49.6368	49.6368	48.7402	48.9548	48.5321	48.7402	49.1757	49.1757	49.8769 (38)
Heat transfer coeff	138.7371	138.2119	138.2119	137.4723	137.4723	136.5757	136.7903	136.3676	136.5757	137.0112	137.0112	137.7124 (39)
Average = Sum(39)m / 12 =												137.3458 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2314	1.2267	1.2267	1.2201	1.2201	1.2122	1.2141	1.2103	1.2122	1.2160	1.2160	1.2223 (40)
HLP (average)												1.2190 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (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 =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411 (61)	
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1140.0998 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1915.3676 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2004 (H8)	
Utilisation factor												0.5653 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												101.4110 (H14)	
Volume ratio Veff/V												0.7396 (H15)	
Solar storage volume factor												0.9397 (H16)	
Solar input												-894.5790 (H17)	
Solar input	-27.5347	-41.3846	-69.6969	-96.3424	-116.0287	-122.1152	-119.1829	-106.4311	-83.0698	-56.5109	-33.4691	-22.8127 (63)	
	Solar input (sum of months) = Sum(63)m =											-894.5790 (63)	
Output from w/h	152.0475	116.0728	93.7198	47.4458	22.9100	0.0000	0.0000	22.1904	46.4910	92.7236	127.7284	151.5371 (64)	
	Total per year (kWh/year) = Sum(64)m =											872.8665 (64)	
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047 (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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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
Northeast	8.3200	12.9236	0.4400	0.0000	0.7700	36.4291 (75)
Southeast	1.4400	40.4699	0.4400	0.0000	0.7700	19.7441 (77)
Southwest	7.2400	40.4699	0.4400	0.0000	0.7700	99.2691 (79)
Northwest	0.8400	12.9236	0.4400	0.0000	0.7700	3.6779 (81)

Solar gains	159.1204	256.2181	378.7919	539.7555	638.4666	701.3735	659.4229	579.9578	464.4623	311.8079	197.8029	133.2692	(83)
Total gains	827.3228	919.1650	1015.4782	1135.6807	1192.3500	1217.9707	1154.5238	1084.5661	992.8050	881.1437	812.6183	782.7855	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	43.9035	
alpha	3.9053	3.9163	3.9163	3.9320	3.9320	3.9513	3.9466	3.9558	3.9513	3.9419	3.9419	3.9269	
util living area	0.9863	0.9785	0.9567	0.8956	0.7638	0.5341	0.3628	0.3957	0.6997	0.9165	0.9748	0.9886	(86)
MIT	19.6128	19.7720	20.0926	20.4909	20.8109	20.9676	20.9948	20.9928	20.9023	20.5189	20.0096	19.5842	(87)
Th 2	19.8950	19.8987	19.8987	19.9039	19.9039	19.9103	19.9088	19.9117	19.9103	19.9072	19.9072	19.9022	(88)
util rest of house	0.9826	0.9727	0.9445	0.8657	0.6980	0.4288	0.2374	0.2645	0.6015	0.8853	0.9668	0.9855	(89)
MIT 2	18.0828	18.3151	18.7743	19.3293	19.7327	19.8930	19.9077	19.9101	19.8425	19.3819	18.6666	18.0464	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	18.2783	18.5013	18.9428	19.4777	19.8705	20.0304	20.0466	20.0485	19.9780	19.5272	18.8383	18.2429	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1283	18.3513	18.7928	19.3277	19.7205	19.8804	19.8966	19.8985	19.8280	19.3772	18.6883	18.0929	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9738	0.9610	0.9279	0.8462	0.6854	0.4258	0.2360	0.2629	0.5931	0.8656	0.9538	0.9777	(94)
Useful gains	805.6496	883.3446	942.3058	961.0534	817.2962	518.6055	272.4136	285.0804	588.8796	762.7604	775.0858	765.3541	(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	1807.5144	1762.3815	1574.6210	1296.0522	923.8763	529.9653	273.1194	286.1648	632.0666	1065.5699	1464.4107	1789.2866	(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	745.3874	590.7128	470.4426	241.1992	79.2956	0.0000	0.0000	0.0000	0.0000	225.2902	496.3140	761.8057	(98)
Space heating												3610.4475	(98)
Space heating per m2											(98) / (4) =	32.0444	(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													3989.4448 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.3874	590.7128	470.4426	241.1992	79.2956	0.0000	0.0000	0.0000	0.0000	225.2902	496.3140	761.8057	(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)	823.6325	652.7213	519.8260	266.5184	87.6195	0.0000	0.0000	0.0000	0.0000	248.9395	548.4132	841.7743	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	152.0475	116.0728	93.7198	47.4458	22.9100	0.0000	0.0000	22.1904	46.4910	92.7236	127.7284	151.5371	(64)
Efficiency of water heater	89.9414	89.9585	89.9523	89.9580	89.7625	87.3000	87.3000	87.3000	87.3000	89.5430	89.8261	87.3000	(216)
(217)m	89.9414	89.9585	89.9523	89.9580	89.7625	87.3000	87.3000	87.3000	87.3000	89.5430	89.8261	89.9529	(217)
Fuel for water heating, kWh/month	169.0516	129.0293	104.1884	52.7422	25.5229	0.0000	0.0000	25.4186	53.2543	103.5520	142.1952	168.4627	(219)
Water heating fuel used												973.4174	(219)
Annual totals kWh/year													
Space heating fuel - main system												3989.4448	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												453.1995	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												3716.9020	(238)

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

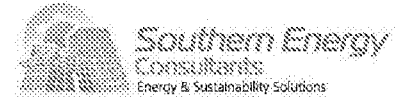
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3989.4448	3.8700	154.3915	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.4174	3.8700	37.6713	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	453.1995	18.9000	85.6547	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			49.5763	(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	3989.4448	0.2160	861.7201	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.4174	0.2160	210.2582	(264)
Space and water heating			1071.9782	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	453.1995	0.5190	235.2106	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			425.3249 (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	3989.4448	1.2200	4867.1226 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	973.4174	1.2200	1187.5692 (264)
Space and water heating			6054.6918 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	453.1995	3.0700	1391.3225 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2229.5942 (272)
Primary energy kWh/m2/year			19.7887 (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 West
Overshading	Average or unknown
Thermal mass parameter	193.2 (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	362.03 (P1)
Transmission heat loss coefficient	87.84 (37)
Summer heat loss coefficient	449.86 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	8.3200	98.8453	0.4400	0.0000	0.9000	325.6675
South East	1.4400	119.9223	0.4400	0.0000	0.9000	68.3845
South West	7.2400	119.9223	0.4400	0.0000	0.9000	343.8222
North West	0.6400	98.8453	0.4400	0.0000	0.9000	32.8799
total:						770.7541

	Jun	Jul	Aug	
Solar gains	820	771	678	(P4)
Internal gains	514	492	502	
Total summer gains	1333	1263	1179	(P5)
Summer gain/loss ratio	2.96	2.81	2.62	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 193.2)	0.65	0.65	0.65	
Threshold temperature	19.61	21.35	21.07	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			