

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG003e			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Coniston+, Plot 47				
SAP Rating	84 B	DER	16.84	TER	17.35
Environmental	85 B	% DER<TER	2.92		
CO ₂ Emissions (t/year)	1.56	DFEE	50.77	TFEE	55.39
General Requirements Compliance	Pass	% DFEE<TFEE	8.34		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey			Assessor ID	T555-0001
Client	Persimmon 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) 17.35 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.84 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (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:

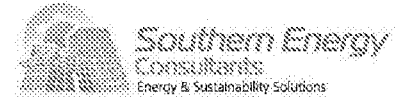
Overshading: Average
Windows facing North: 8.32 m², No overhang
Windows facing East: 1.44 m², No overhang
Windows facing South: 7.24 m², No overhang
Windows facing West: 0.84 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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)
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	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	
North					8.3200	10.6334	0.4400	0.0000	0.7700		29.9736 (74)	
East					1.4400	19.6403	0.4400	0.0000	0.7700		9.5819 (76)	
South					7.2400	46.7521	0.4400	0.0000	0.7700		114.6787 (78)	
West					0.8400	19.6403	0.4400	0.0000	0.7700		5.5895 (80)	
Solar gains	159.8237	274.7737	385.4526	498.0225	579.7386	586.0566	560.5829	497.4353	423.7891	305.9768	191.8266	136.5566 (83)
Total gains	607.9598	720.5508	814.9001	901.0131	955.5320	935.9715	893.9153	837.3783	777.5358	686.4123	602.8970	570.9203 (84)

7. Mean internal temperature (heating season)

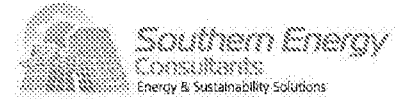
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	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	0.9960	0.9918	0.9825	0.9574	0.8961	0.7724	0.6222	0.6734	0.8690	0.9705	0.9926	0.9969	(86)
MIT	19.2563	19.4531	19.7666	20.1797	20.5646	20.8416	20.9503	20.9315	20.7222	20.2224	19.6631	19.2227	(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	0.9949	0.9896	0.9773	0.9436	0.8593	0.6885	0.4905	0.5455	0.8085	0.9583	0.9902	0.9960	(89)
MIT 2	17.5524	17.8406	18.2975	18.8970	19.4287	19.7766	19.8783	19.8675	19.6458	18.9667	18.1552	17.5090	(90)
Living area fraction	17.7701	18.0467	18.4853	19.0609	19.5738	19.9127	20.0153	20.0034	19.7834	19.1272	18.3480	17.7280	(91)
MIT	17.7701	18.0467	18.4853	19.0609	19.5738	19.9127	20.0153	20.0034	19.7834	19.1272	18.3480	17.7280	(92)
Temperature adjustment	17.6201	17.8967	18.3353	18.9109	19.4238	19.7627	19.8653	19.8534	19.6334	18.9772	18.1980	17.5780	(93)
adjusted MIT	17.6201	17.8967	18.3353	18.9109	19.4238	19.7627	19.8653	19.8534	19.6334	18.9772	18.1980	17.5780	(93)

8. Space heating requirement

Utilisation	0.9913	0.9833	0.9667	0.9267	0.8395	0.6760	0.4856	0.5389	0.7900	0.9435	0.9843	0.9930	(94)
Useful gains	602.6454	708.5011	787.7897	835.0082	802.1683	632.7183	434.1041	451.2448	614.2178	647.6285	593.4085	566.9522	(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	1883.6944	1833.7560	1666.1287	1394.4010	1073.6835	710.9636	449.6789	474.7533	764.7785	1164.5081	1548.9719	1875.0932	(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	953.1004	756.1713	653.4842	402.7628	202.0073	0.0000	0.0000	0.0000	0.0000	384.5584	688.0057	973.2569	(98)
Space heating												5013.3470	(98)
Space heating per m2												(98) / (4) =	44.4958 (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													5539.6099 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	953.1004	756.1713	653.4842	402.7628	202.0073	0.0000	0.0000	0.0000	0.0000	384.5584	688.0057	973.2569	(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)	1053.1497	835.5484	722.0820	445.0418	223.2125	0.0000	0.0000	0.0000	0.0000	424.9264	760.2272	1075.4220	(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	89.9771	89.9319	89.8412	89.6356	89.1681	87.3000	87.3000	87.3000	87.3000	89.5820	89.8747	87.3000	(216)
Fuel for water heating, kWh/month	199.5865	175.0852	181.8950	160.4142	155.8166	138.9748	130.4075	147.3327	148.4088	166.5898	179.3582	193.7246	(219)
Water heating fuel used												1977.5940	(219)
Annual totals kWh/year													
Space heating fuel - main system												5539.6099	(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												8045.4034	(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	5539.6099	0.2160	1196.5557	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1977.5940	0.2160	427.1603	(264)
Space and water heating			1623.7160	(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			1897.8516	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8400	(273)

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

DER		16.8400	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		32.9802	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		32.9802	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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

	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	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)
Total heat required for water heating calculated for each 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 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	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)
Heat gains from water heating, kWh/month	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
North				8.3200	10.6334		0.6300		0.7000		0.7700		27.0375 (74)
East				1.4400	19.6403		0.6300		0.7000		0.7700		8.6433 (76)
South				7.2400	46.7521		0.6300		0.7000		0.7700		103.4454 (78)
West				0.8400	19.6403		0.6300		0.7000		0.7700		5.0419 (80)
Solar gains	144.1682	247.8583	347.6958	449.2389	522.9505	528.6497	505.6713	448.7092	382.2770	276.0050	173.0363	123.1803	(83)
Total gains	604.6717	706.0071	789.5236	864.5168	910.3484	889.4886	849.9360	800.2647	748.3228	668.8323	596.4846	569.9156	(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	0.9988	0.9971	0.9926	0.9770	0.9272	0.8012	0.6351	0.6889	0.8981	0.9849	0.9974	0.9991	(86)
MIT	19.6663	19.8189	20.0639	20.3907	20.6960	20.9072	20.9778	20.9669	20.8170	20.4225	19.9847	19.6414	(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	0.9984	0.9961	0.9898	0.9674	0.8942	0.7148	0.5013	0.5577	0.8394	0.9769	0.9963	0.9988	(89)
MIT 2	18.1567	18.3814	18.7399	19.2185	19.6406	19.8993	19.9576	19.9533	19.8048	19.2701	18.6318	18.1266	(90)
Living area fraction	18.3497	18.5651	18.9091	19.3684	19.7755	20.0281	20.0880	20.0829	19.9341	19.4174	18.6047	18.3202	(92)
Temperature adjustment	18.3497	18.5651	18.9091	19.3684	19.7755	20.0281	20.0880	20.0829	19.9341	19.4174	18.6047	18.3202	(93)
adjusted MIT	18.3497	18.5651	18.9091	19.3684	19.7755	20.0281	20.0880	20.0829	19.9341	19.4174	18.6047	18.3202	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	603.0847	701.8634	778.3340	829.9426	807.5174	641.0549	440.3395	459.0180	626.6426	649.3552	593.1634	568.7959	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1860.3870	1805.0435	1635.2073	1363.8764	1049.8670	698.6544	448.9410	473.1383	753.8252	1146.3228	1528.2960	1852.0078	(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	935.4329	741.3371	637.5137	384.4323	180.3081	0.0000	0.0000	0.0000	0.0000	369.7439	673.2955	954.7097	(98)
Space heating												4876.7732	(98)
Space heating per m ²												43.2837	(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													5221.3846 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	935.4329	741.3371	637.5137	384.4323	180.3081	0.0000	0.0000	0.0000	0.0000	369.7439	673.2955	954.7097	(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)	1001.5342	793.7228	682.5629	411.5978	193.0493	0.0000	0.0000	0.0000	0.0000	395.8714	720.8731	1022.1731	(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	88.3132	88.1318	87.7614	86.9242	85.1485	80.3000	80.3000	80.3000	80.3000	86.7468	87.8989	88.3864	(216)
Fuel for water heating, kWh/month	245.0228	216.3944	228.1878	206.1285	203.7307	190.2689	182.2921	203.2130	205.4572	214.5467	223.9455	238.9141	(219)
Water heating fuel used												2558.1017	(219)
Annual totals kWh/year													
Space heating fuel - main system												5221.3846	(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												8307.6858	(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	5221.3846	0.2160	1127.8191 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2558.1017	0.2160	552.5500 (264)
Space and water heating			1680.3690 (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			1954.5046 (272)
Emissions per m2 for space and water heating			14.9141 (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) = (14.9141 * 1.00) + 2.0876 + 0.3455, rounded to 2 d.p.			17.3500 (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	
North					8.3200	10.6334	0.4400	0.0000	0.7700		29.9736 (74)	
East					1.4400	19.6403	0.4400	0.0000	0.7700		9.5819 (76)	
South					7.2400	46.7521	0.4400	0.0000	0.7700		114.6787 (78)	
West					0.8400	19.6403	0.4400	0.0000	0.7700		5.5895 (80)	
Solar gains	159.8237	274.7737	385.4526	498.0225	579.7386	586.0566	560.5829	497.4353	423.7891	305.9768	191.8266	136.5566 (83)
Total gains	573.5218	686.9626	783.0762	871.5886	927.6689	910.3044	870.1111	811.1834	750.4887	656.8819	570.5631	537.3285 (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	0.9964	0.9925	0.9836	0.9596	0.9009	0.7812	0.6332	0.6861	0.8767	0.9729	0.9934	0.9972	(86)
MIT	19.1921	19.3934	19.7148	20.1390	20.5363	20.8268	20.9440	20.9228	20.6995	20.1815	19.6081	19.1586	(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	0.9904	0.9788	0.9466	0.8657	0.6990	0.5013	0.5589	0.8190	0.9617	0.9913	0.9965	(89)
MIT 2	18.2282	18.4303	18.7510	19.1753	19.5523	19.8068	19.8834	19.8751	19.7089	19.2233	18.6531	18.2014	(90)
Living area fraction	18.3514	18.5534	18.8742	19.2984	19.6780	19.9371	20.0189	20.0090	19.8355	19.3458	18.7752	18.3237	(92)
Temperature adjustment	18.3514	18.5534	18.8742	19.2984	19.6780	19.9371	20.0189	20.0090	19.8355	19.3458	18.7752	18.3237	(93)
adjusted MIT	18.3514	18.5534	18.8742	19.2984	19.6780	19.9371	20.0189	20.0090	19.8355	19.3458	18.7752	18.3237	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	569.8113	678.0309	761.9172	817.2070	795.3008	639.0785	449.5593	464.4086	611.5818	626.8199	563.7974	534.5987	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1987.1050	1926.4141	1741.9954	1448.3760	1109.0217	734.9906	470.8298	496.1343	792.7104	1215.7449	1629.5398	1979.6067	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1054.4665	838.9135	729.1782	454.4416	233.4084	0.0000	0.0000	0.0000	0.0000	438.1602	767.3345	1075.0859	(98)
Space heating												5590.9888	(98)
Space heating per m2												49.6227	(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													

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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	0.7544	0.8320	0.8001	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	976.6209	847.8682	835.8957	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9314	1126.5235	1059.8312	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	143.5035	207.3196	166.6080	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			517.4311 (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	35.8759	51.8299	41.6520	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												129.3578 (107)
Energy for space heating												1.1481 (108)
Energy for space cooling												49.6227 (99)
Total												1.1481 (108)
Dwelling Fabric Energy Efficiency (DFEE)												50.7708 (109)
												50.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Target Fabric Energy Efficiency 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
Calculation of Target Fabric Energy Efficiency 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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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	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	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.3200	10.6334	0.6300	0.7000	0.7700	27.0375 (74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (76)
South	7.2400	46.7521	0.6300	0.7000	0.7700	103.4454 (78)
West	0.8400	19.6403	0.6300	0.7000	0.7700	5.0419 (80)

Solar gains	144.1682	247.8583	347.6958	449.2389	522.9505	528.6497	505.6713	448.7092	382.2770	276.0050	173.0363	123.1803	(83)
Total gains	557.8664	660.0472	745.3194	822.8050	870.8808	852.8975	815.1995	762.4574	708.9766	626.9101	551.7729	523.9521	(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	0.9992	0.9979	0.9943	0.9811	0.9373	0.8199	0.6569	0.7140	0.9138	0.9885	0.9982	0.9994	(86)
MIT	19.6277	19.7813	20.0285	20.3596	20.6728	20.8961	20.9743	20.9611	20.7968	20.3900	19.9480	19.6034	(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	0.9989	0.9971	0.9920	0.9730	0.9076	0.7363	0.5211	0.5821	0.8607	0.9822	0.9974	0.9992	(89)
MIT 2	18.6839	18.8391	19.0871	19.4225	19.7213	19.9140	19.9593	19.9559	19.8399	19.4567	19.0144	18.6667	(90)
Living area fraction									fLA = Living area / (4) =			0.1278	(91)
MIT	18.8045	18.9595	19.2074	19.5422	19.8429	20.0395	20.0890	20.0844	19.9622	19.5760	19.1337	18.7864	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8045	18.9595	19.2074	19.5422	19.8429	20.0395	20.0890	20.0844	19.9622	19.5760	19.1337	18.7864	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	556.9836	657.4982	737.7866	797.1132	786.8426	633.7730	438.8788	456.3062	610.1984	613.7110	549.8471	523.3480	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1920.6129	1857.1382	1674.5083	1386.5317	1058.6313	700.1230	449.0699	473.3348	757.4571	1166.9388	1571.2502	1913.1519	(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	1014.5402	806.1581	696.9210	424.3814	202.2108	0.0000	0.0000	0.0000	0.0000	411.6014	735.4102	1034.0141	(98)
Space heating												5325.2372	(98)
Space heating per m ²										(98) / (4) =		47.2640	(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	0.7964	0.8768	0.8460	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	963.5072	835.1169	825.9792	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1108.8324	1062.3411	1002.8787	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)



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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.6341	169.0548	131.6132	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												405.3021 (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	26.1585	42.2637	32.9033	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												101.3255 (107)
Space cooling per m2												0.8993 (108)
Energy for space heating												47.2640 (99)
Energy for space cooling												0.8993 (108)
Total												48.1633 (109)
Target Fabric Energy Efficiency (TFEE)												55.4 (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	
North					8.3200	11.9814	0.4400	0.0000	0.7700		33.7735 (74)	
East					1.4400	22.3313	0.4400	0.0000	0.7700		10.8948 (76)	
South					7.2400	50.9848	0.4400	0.0000	0.7700		125.0613 (78)	
West					0.8400	22.3313	0.4400	0.0000	0.7700		6.3553 (80)	

Solar gains	176.0849	272.7607	379.5693	508.9529	580.3956	629.2370	594.8475	537.4796	453.5444	324.6993	216.5688	148.9768 (83)
Total gains	844.2873	935.7076	1016.2556	1104.8781	1134.2790	1145.8342	1089.9484	1042.0878	981.8871	894.0351	831.3842	798.4931 (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	0.9854	0.9772	0.9566	0.9027	0.7847	0.5622	0.3833	0.4109	0.7048	0.9132	0.9729	0.9878 (86)
MIT	19.6286	19.7870	20.0933	20.4711	20.7902	20.9612	20.9937	20.9918	20.8997	20.5278	20.0263	19.5990 (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	0.9814	0.9711	0.9443	0.8741	0.7208	0.4536	0.2513	0.2751	0.6067	0.8811	0.9643	0.9845 (89)
MIT 2	18.1057	18.3365	18.7752	19.3038	19.7113	19.8893	19.9074	19.9099	19.8404	19.3932	18.6903	18.0679 (90)
Living area fraction	18.3003	18.5219	18.9437	19.4530	19.8492	20.0263	20.0463	20.0481	19.9758	19.5382	18.6610	18.2636 (92)
MIT	18.3003	18.5219	18.9437	19.4530	19.8492	20.0263	20.0463	20.0481	19.9758	19.5382	18.6610	18.2636 (91)
Temperature adjustment	18.1503	18.3719	18.7937	19.3030	19.6992	19.8763	19.8963	19.8981	19.8258	19.3882	18.7110	-0.1500
adjusted MIT	18.1503	18.3719	18.7937	19.3030	19.6992	19.8763	19.8963	19.8981	19.8258	19.3882	18.7110	18.1136 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	820.8299	897.4078	942.8884	944.2119	802.0563	515.6303	272.2013	284.8659	587.3127	770.2033	790.5530	779.6320	(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	1810.5664	1765.2234	1574.7399	1292.6563	920.9523	529.4077	273.0704	286.1169	631.7710	1067.0763	1467.5285	1792.1325	(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	(98a)
Space heating kWh	736.3640	583.1721	470.0975	250.8799	88.4586	0.0000	0.0000	0.0000	0.0000	220.8735	487.4224	753.3003	(98)
Space heating												3590.5682	(98)
RHI space heating demand												3591	(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	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)

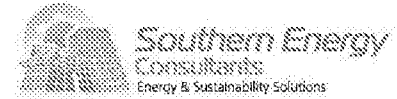
Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 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		FF		Access factor Table 6d		Gains W
							Specific data or Table 6b		Specific data or Table 6c				
North			8.3200		10.6334		0.4400		0.0000		0.7700		29.9736 (74)
East			1.4400		19.6403		0.4400		0.0000		0.7700		9.5819 (76)
South			7.2400		46.7521		0.4400		0.0000		0.7700		114.6787 (78)
West			0.8400		19.6403		0.4400		0.0000		0.7700		5.5895 (80)
Solar gains	159.8237	274.7737	385.4526	498.0225	579.7386	586.0566	560.5829	497.4353	423.7891	305.9768	191.8266	136.5566	(83)
Total gains	828.0261	937.7206	1022.1389	1093.9477	1133.6219	1102.6539	1055.6838	1002.0435	952.1318	875.3126	806.6420	786.0728	(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	0.9884	0.9804	0.9643	0.9258	0.8446	0.6997	0.5444	0.5886	0.7972	0.9390	0.9805	0.9905	(86)
MIT	19.4677	19.6564	19.9505	20.3294	20.6655	20.8902	20.9688	20.9574	20.8056	20.3778	19.8549	19.4312	(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	0.9854	0.9753	0.9546	0.9044	0.7978	0.6112	0.4216	0.4663	0.7230	0.9170	0.9745	0.9880	(89)
MIT 2	17.8594	18.1339	18.5585	19.1003	19.5504	19.8198	19.8881	19.8828	19.7332	19.1784	18.4312	17.8122	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	18.0649	18.3285	18.7364	19.2574	19.6929	19.9566	20.0262	20.0201	19.8703	19.3317	18.6131	18.0191	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9149	18.1785	18.5864	19.1074	19.5429	19.8066	19.8762	19.8701	19.7203	19.1817	18.4631	17.8691	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9775	0.9641	0.9391	0.8850	0.7801	0.6026	0.4186	0.4622	0.7088	0.8980	0.9632	0.9811	(94)	
Useful gains	809.3975	904.0965	959.9338	968.1716	884.3226	664.4385	441.8657	463.1865	674.8487	786.0404	776.9389	771.2060	(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	1925.3855	1873.5132	1701.4885	1421.7681	1090.2330	717.0158	451.1790	477.0463	776.7916	1192.9316	1585.9830	1915.8941	(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	830.2950	651.4480	551.7167	326.5895	153.1974	0.0000	0.0000	0.0000	0.0000	302.7270	582.5117	851.6479	(98)	
Space heating												4250.1332	(98)	
Space heating per m2												(98) / (4) =	37.7220	(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												4696.2798 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	830.2950	651.4480	551.7167	326.5895	153.1974	0.0000	0.0000	0.0000	0.0000	302.7270	582.5117	851.6479 (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)	917.4531	719.8320	609.6317	360.8723	169.2789	0.0000	0.0000	0.0000	0.0000	334.5050	643.6594	941.0474 (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	89.9139	89.8588	89.7483	89.4972	88.9493	87.3000	87.3000	87.3000	87.3000	89.4178	89.7866	87.3000 (216)
Fuel for water heating, kWh/month	199.7268	175.2275	182.0835	160.6623	156.1998	138.9748	130.4075	147.3327	148.4088	166.8958	179.5340	193.8517 (219)
Water heating fuel used												1979.3051 (219)
Annual totals kWh/year												
Space heating fuel - main system												4696.2798 (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												7203.7845 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4696.2798	3.4800	163.4305 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1979.3051	3.4800	68.8798 (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			421.9799 (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] =	1.1241 (257)
SAP value		84.3193
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	4696.2798	0.2160	1014.3964 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.3051	0.2160	427.5299 (264)
Space and water heating			1441.9264 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1716.0619 (272)
CO2 emissions per m2			15.2300 (273)
EI value			85.4156
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			
North				8.3200	11.9814	0.4400	0.0000	0.7700	33.7735 (74)			
East				1.4400	22.3313	0.4400	0.0000	0.7700	10.8948 (76)			
South				7.2400	50.9848	0.4400	0.0000	0.7700	125.0613 (78)			
West				0.8400	22.3313	0.4400	0.0000	0.7700	6.3553 (80)			
Solar gains	176.0849	272.7607	379.5693	508.9529	580.3956	629.2370	594.8475	537.4796	453.5444	324.6993	216.5688	148.9768 (83)
Total gains	844.2873	935.7076	1016.2556	1104.8781	1134.2790	1145.8342	1089.9484	1042.0878	981.8871	894.0351	831.3842	798.4931 (84)

7. Mean internal temperature (heating season)

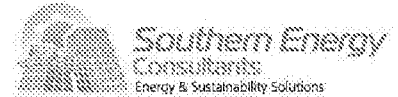
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	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	0.9854	0.9772	0.9566	0.9027	0.7847	0.5622	0.3833	0.4109	0.7048	0.9132	0.9729	0.9878	(86)
MIT	19.6286	19.7870	20.0933	20.4711	20.7902	20.9612	20.9937	20.9918	20.8997	20.5278	20.0263	19.5990	(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	0.9814	0.9711	0.9443	0.8741	0.7208	0.4536	0.2513	0.2751	0.6067	0.8811	0.9643	0.9845	(89)
MIT 2	18.1057	18.3365	18.7752	19.3038	19.7113	19.8893	19.9074	19.9099	19.8404	19.3932	18.6903	18.0679	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	18.3003	18.5219	18.9437	19.4530	19.8492	20.0263	20.0463	20.0481	19.9758	19.5382	18.8610	18.2636	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1503	18.3719	18.7937	19.3030	19.6992	19.8763	19.8963	19.8981	19.8258	19.3882	18.7110	18.1136	(93)

8. Space heating requirement

Utilisation	0.9722	0.9591	0.9278	0.8546	0.7071	0.4500	0.2497	0.2734	0.5981	0.8615	0.9509	0.9764	(94)
Useful gains	820.8299	897.4078	942.8884	944.2119	802.0563	515.6303	272.2013	284.8659	587.3127	770.2033	790.5530	779.6320	(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	1810.5664	1765.2234	1574.7399	1292.6563	920.9523	529.4077	273.0704	286.1169	631.7710	1067.0763	1467.5285	1792.1325	(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	736.3640	583.1721	470.0975	250.8799	88.4586	0.0000	0.0000	0.0000	0.0000	220.8735	487.4224	753.3003	(98)
Space heating												3590.5682	(98)
Space heating per m2												(98) / (4) =	31.8680 (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													3967.4787 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	736.3640	583.1721	470.0975	250.8799	88.4586	0.0000	0.0000	0.0000	0.0000	220.8735	487.4224	753.3003	(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)	813.6618	644.3891	519.4448	277.2154	97.7443	0.0000	0.0000	0.0000	0.0000	244.0591	538.5883	832.3760	(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	89.8542	89.8002	89.6523	89.3073	88.5175	87.3000	87.3000	87.3000	87.3000	89.1819	89.6830	87.3000	(216)
(217)m	89.8542	89.8002	89.6523	89.3073	88.5175	87.3000	87.3000	87.3000	87.3000	89.1819	89.6830	89.8808	(217)
Fuel for water heating, kWh/month	199.8594	175.3420	182.2783	161.0038	156.9618	138.9748	130.4075	147.3327	148.4088	167.3372	179.7414	193.9790	(219)
Water heating fuel used	199.8594	175.3420	182.2783	161.0038	156.9618	138.9748	130.4075	147.3327	148.4088	167.3372	179.7414	1981.6266	(219)
Annual totals kWh/year													
Space heating fuel - main system												3967.4787	(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												6477.3049	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3967.4787	3.8700	153.5414 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1981.6266	3.8700	76.6890 (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			423.0601 (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	3967.4787	0.2160	856.9754 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.6266	0.2160	428.0314 (264)
Space and water heating			1285.0068 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1559.1423 (272)

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

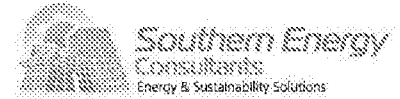
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3967.4787	1.2200	4840.3240 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.6266	1.2200	2417.5845 (264)
Space and water heating			7257.9085 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	453.1995	3.0700	1391.3225 (268)
Primary energy kWh/year			8879.4811 (272)
Primary energy kWh/m2/year			78.8096 (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 (69.2%)

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	£323	£284	£39
Space heating	£261	£261	£0
Water heating	£77	£47	£30
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£423	£48	£375
Total cost of uses	£424	£49	£375
Delivered energy	57 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

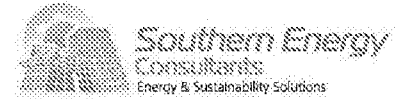
Elmhurst Energy Systems

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
North	8.3200	10.6334	0.4400	0.0000	0.7700	29.9736 (74)
East	1.4400	19.6403	0.4400	0.0000	0.7700	9.5819 (76)
South	7.2400	46.7521	0.4400	0.0000	0.7700	114.6787 (78)
West	0.8400	19.6403	0.4400	0.0000	0.7700	5.5895 (80)

Solar gains	159.8237	274.7737	385.4526	498.0225	579.7386	586.0566	560.5829	497.4353	423.7891	305.9768	191.8266	136.5566 (83)
Total gains	828.0261	937.7206	1022.1389	1093.9477	1133.6219	1102.6539	1055.6838	1002.0435	952.1318	875.3126	806.6420	786.0728 (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	0.9884	0.9804	0.9643	0.9258	0.8446	0.6997	0.5444	0.5886	0.7972	0.9390	0.9805	0.9905 (86)
MIT	19.4677	19.6564	19.9505	20.3294	20.6655	20.8902	20.9688	20.9574	20.8056	20.3778	19.8549	19.4312 (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	0.9854	0.9753	0.9546	0.9044	0.7978	0.6112	0.4216	0.4663	0.7230	0.9170	0.9745	0.9880 (89)
MIT 2	17.8594	18.1339	18.5585	19.1003	19.5504	19.8198	19.8881	19.8828	19.7332	19.1784	18.4312	17.8122 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	18.0649	18.3285	18.7364	19.2574	19.6929	19.9566	20.0262	20.0201	19.8703	19.3317	18.6131	18.0191 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9149	18.1785	18.5864	19.1074	19.5429	19.8066	19.8762	19.8701	19.7203	19.1817	18.4631	17.8691 (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	0.9775	0.9641	0.9391	0.8850	0.7801	0.6026	0.4186	0.4622	0.7088	0.8980	0.9632	0.9811	(94)
Useful gains	809.3975	904.0965	959.9338	968.1716	884.3226	664.4385	441.8657	463.1865	674.8487	786.0404	776.9389	771.2060	(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	1925.3855	1873.5132	1701.4885	1421.7681	1090.2330	717.0158	451.1790	477.0463	776.7916	1192.9316	1585.9830	1915.8941	(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	830.2950	651.4480	551.7167	326.5895	153.1974	0.0000	0.0000	0.0000	0.0000	302.7270	582.5117	851.6479	(98)
Space heating												4250.1332	(98)
Space heating per m2											(98) / (4) =	37.7220	(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													4696.2798 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	830.2950	651.4480	551.7167	326.5895	153.1974	0.0000	0.0000	0.0000	0.0000	302.7270	582.5117	851.6479	(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)	917.4531	719.8320	609.6317	360.8723	169.2789	0.0000	0.0000	0.0000	0.0000	334.5050	643.6594	941.0474	(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	89.9835	90.0049	90.0321	90.0850	90.1304	87.3000	87.3000	87.3000	87.3000	89.7145	89.8949	87.3000	(216)
(217)m													89.9974 (217)
Fuel for water heating, kWh/month	171.3167	127.8039	101.2501	52.1137	21.4124	4.2385	0.0000	31.1687	57.4290	105.8873	145.7696	170.0861	(219)
Water heating fuel used												988.4760	(219)
Annual totals kWh/year													
Space heating fuel - main system												4696.2798	(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												4535.7159	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4696.2798	3.4800	163.4305	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	988.4760	3.4800	34.3990	(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			166.2711	(255)

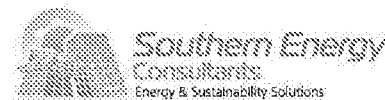
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.4429 (257)
SAP value			93.8214
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	4696.2798	0.2160	1014.3964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	988.4760	0.2160	213.5108	(264)
Space and water heating			1227.9073	(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			631.5556	(272)
CO2 emissions per m2			5.6100	(273)
EI value			94.6326	
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)

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
North	8.3200	11.9814	0.4400	0.0000	0.7700	33.7735 (74)
East	1.4400	22.3313	0.4400	0.0000	0.7700	10.8948 (76)
South	7.2400	50.9848	0.4400	0.0000	0.7700	125.0613 (78)
West	0.8400	22.3313	0.4400	0.0000	0.7700	6.3553 (80)

Solar gains	176.0849	272.7607	379.5693	508.9529	580.3956	629.2370	594.8475	537.4796	453.5444	324.6993	216.5688	148.9768 (83)
Total gains	844.2873	935.7076	1016.2556	1104.8761	1134.2790	1145.8342	1089.9484	1042.0878	981.8671	894.0351	831.3842	798.4931 (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	0.9854	0.9772	0.9566	0.9027	0.7847	0.5622	0.3833	0.4109	0.7048	0.9132	0.9729	0.9878 (86)
MIT	19.6286	19.7870	20.0933	20.4711	20.7902	20.9612	20.9937	20.9918	20.8997	20.5278	20.0263	19.5990 (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	0.9814	0.9711	0.9443	0.8741	0.7208	0.4536	0.2513	0.2751	0.6067	0.8811	0.9643	0.9845 (89)
MIT 2	18.1057	18.3365	18.7752	19.3038	19.7113	19.8893	19.9074	19.9099	19.8404	19.3932	18.6903	18.0679 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	18.3003	18.5219	18.9437	19.4530	19.8492	20.0263	20.0463	20.0481	19.9758	19.5382	18.6610	18.2636 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1503	18.3719	18.7937	19.3030	19.6992	19.8763	19.8963	19.8981	19.8258	19.3882	18.7110	18.1136 (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	0.9722	0.9591	0.9278	0.8546	0.7071	0.4500	0.2497	0.2734	0.5981	0.8615	0.9509	0.9764	(94)
Useful gains	820.8299	897.4078	942.8884	944.2119	802.0563	515.6303	272.2013	284.8659	587.3127	770.2033	790.5530	779.6320	(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	1810.5664	1765.2234	1574.7399	1292.6563	920.9523	529.4077	273.0704	286.1169	631.7710	1067.0763	1467.5285	1792.1325	(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	736.3640	583.1721	470.0975	250.8799	88.4586	0.0000	0.0000	0.0000	0.0000	220.8735	487.4224	753.3003	(98)
Space heating												3590.5682	(98)
Space heating per m2											(98) / (4) =	31.8680	(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													3967.4787 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	736.3640	583.1721	470.0975	250.8799	88.4586	0.0000	0.0000	0.0000	0.0000	220.8735	487.4224	753.3003	(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)	813.6618	644.3891	519.4448	277.2154	97.7443	0.0000	0.0000	0.0000	0.0000	244.0591	538.5883	832.3760	(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	89.9358	89.9527	89.9519	89.9755	89.8227	87.3000	87.3000	87.3000	87.3000	89.5297	89.8164	87.3000	(216)
(217)m	89.9358	89.9527	89.9519	89.9755	89.8227	87.3000	87.3000	87.3000	87.3000	89.5297	89.8164	89.9478	(217)
Fuel for water heating, kWh/month	169.0622	129.0377	104.1888	52.7319	25.5058	0.0000	0.0000	25.4186	53.2543	103.5675	142.2105	168.4723	(219)
Water heating fuel used												973.4496	(219)
Annual totals kWh/year													
Space heating fuel - main system												3967.4787	(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												3694.9682	(238)

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

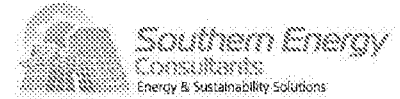
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3967.4787	3.8700	153.5414	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.4496	3.8700	37.6725	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	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			48.7275	(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	3967.4787	0.2160	856.9754	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.4496	0.2160	210.2651	(264)
Space and water heating			1067.2405	(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			420.5872 (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	3967.4787	1.2200	4840.3240 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	973.4496	1.2200	1187.6085 (264)
Space and water heating			6027.9326 (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			2202.8350 (272)
Primary energy kWh/m2/year			19.5512 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	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	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.3200	81.1852	0.4400	0.0000	0.9000	267.4824
East	1.4400	117.5071	0.4400	0.0000	0.9000	67.0072
South	7.2400	112.2060	0.4400	0.0000	0.9000	321.6991
West	0.6400	117.5071	0.4400	0.0000	0.9000	39.0876

total: 695.2763

	Jun	Jul	Aug	
Solar gains	735	695	628	(P4)
Internal gains	514	492	502	
Total summer gains	1249	1187	1130	(P5)
Summer gain/loss ratio	2.78	2.64	2.51	(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	19.42	21.19	20.96	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			