

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG001d			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br CI Ea Ga		
Property	Holywell, Plot 27				
SAP Rating	85 B	DER	15.87	TET	16.35
Environmental	36 B	% DER<TER	2.94		
CO ₂ Emissions (t/year)	1.68	DPEE	48.59	TPEE	53.36
General Requirements Compliance	Pass	% DPEE<TPEE	8.94		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 129 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) 16.35 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.87 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.6 kWh/m²/yr OK

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: 10.07 m², No overhang
Windows facing South: 8.11 m², No overhang
Windows facing West: 0.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.035 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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.4384 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (46)
Water storage loss:											
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554 (64)
Heat gains from water heating, kWh/month	59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877 (65)
Total per year (kWh/year) = Sum(64)m =											1784.6736 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	473.7289	471.2807	453.9207	425.7615	396.6791	369.1606	351.6389	358.4011	373.1975	401.5921	434.1631	459.0584	(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											10.0700		10.6334		0.4400		0.0000		0.7700		36.2781	(74)	
South											8.1100		46.7521		0.4400		0.0000		0.7700		128.4592	(78)	
West											0.6000		19.6403		0.4400		0.0000		0.7700		3.9925	(80)	
Solar gains	168.7297	287.5224	398.6603	510.8753	593.5259	600.1699	573.9613	509.5927	436.5498	318.7127	201.9998	144.5270	(83)										
Total gains	642.4586	758.8032	852.5810	936.6368	990.2050	969.3305	925.6003	867.9939	809.7473	720.3048	636.1629	603.5854	(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	43.5789	43.6751	43.7699	44.2205	44.3058	44.7075	44.7075	44.7827	44.5519	44.3058	44.1335	43.9548
alpha	3.9053	3.9117	3.9180	3.9480	3.9537	3.9805	3.9805	3.9855	3.9701	3.9537	3.9422	3.9303
util living area	0.9965	0.9929	0.9849	0.9632	0.9081	0.7912	0.6428	0.6935	0.8815	0.9740	0.9936	0.9973 (86)
MIT	19.2696	19.4596	19.7629	20.1657	20.5488	20.8322	20.9466	20.9269	20.7127	20.2179	19.6696	19.2368 (87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433 (88)
util rest of house	0.9956	0.9910	0.9806	0.9515	0.8759	0.7138	0.5166	0.5722	0.8274	0.9636	0.9916	0.9966 (89)
MIT 2	17.6159	17.8944	18.3369	18.9233	19.4575	19.8201	19.9316	19.9191	19.6848	19.0055	18.2084	17.5732 (90)
Living area fraction	17.8180	18.0856	18.5112	19.0752	19.5909	19.9438	20.0557	20.0422	19.8104	19.1537	18.3870	17.7765 (92)
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	2036.0821	1981.0858	1798.6969	1504.7820	1159.6739	771.0919	490.7771	517.6059	828.4120	1258.9665	1674.9551	2027.5036 (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	1040.4863	828.8109	722.2835	452.3854	232.2928	0.0000	0.0000	0.0000	0.0000	427.6698	754.2344	1062.0973 (98)
Space heating												5520.2605 (98)
Space heating per m2												42.8060 (99)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	637.5791	747.7362	827.8858	876.4689	847.4523	677.8160	471.5098	488.7967	654.1101	684.1415	627.4073	599.9534	(95)
Heat loss rate W	2036.0821	1981.0858	1798.6969	1504.7820	1159.6739	771.0919	490.7771	517.6059	828.4120	1258.9665	1674.9551	2027.5036	(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	1040.4863	828.8109	722.2835	452.3854	232.2928	0.0000	0.0000	0.0000	0.0000	427.6698	754.2344	1062.0973	(98)
Space heating												5520.2605	(98)
Space heating per m2												42.8060	(99)

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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													6099.7353	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1040.4863	828.8109	722.2835	452.3854	232.2928	0.0000	0.0000	0.0000	0.0000	427.6698	754.2344	1062.0973	(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)	1149.7086	915.8131	798.1033	499.8734	256.6772	0.0000	0.0000	0.0000	0.0000	472.5634	833.4082	1173.5882	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	90.0088	89.9676	89.8855	89.6990	89.2653	87.3000	87.3000	87.3000	87.3000	89.6417	89.9133	90.0293	(217)	
Fuel for water heating, kWh/month	202.2045	177.3680	184.2350	162.4254	157.6978	140.7841	132.0841	149.2571	150.3538	168.6841	181.6811	196.2618	(219)	
Water heating fuel used												2003.0367	(219)	
Annual totals kWh/year														
Space heating fuel - main system													6099.7353	(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)													496.5096	(232)
Total delivered energy for all uses													8674.2816	(238)

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

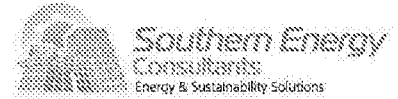
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6099.7353	0.2160	1317.5428 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.0367	0.2160	432.6559 (264)
Space and water heating			1750.1988 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total CO2, kg/year			2046.8122 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8700 (273)

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

DER		15.8700	ZC1
Total Floor Area	TFA	128.9600	
Assumed number of occupants	N	2.8922	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6226	ZC2
CO2 emissions from cooking, equation (L16)		1.4610	ZC3
Total CO2 emissions		30.9537	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		30.9537	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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.3258	24.8977		(27)
Heat Loss Floor 1			64.4800	0.1300	8.3824		(28a)
Brick Cavity	120.4500	19.7100	100.7400	0.1800	18.1332		(29a)
Clad Cavity	36.8100	3.3700	33.4400	0.1800	6.0192		(29a)
Main Plane	64.4800		64.4800	0.1300	8.3824		(30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.5449		(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)							12.3550 (36)
Total fabric heat loss						(33) + (36) =	82.8999 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	142.9310	142.5953	142.2663	140.7210	140.4319	139.0860	139.0860	138.8368	139.6044	140.4319	141.0168	141.6283 (39)
Average = Sum(39)m / 12 =												140.7196 (39)
HLP	1.1083	1.1057	1.1032	1.0912	1.0890	1.0785	1.0785	1.0766	1.0825	1.0890	1.0935	1.0982 (40)
HLP (average)												1.0912 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)
Energy content (annual)										Total = Sum(45)m =		1618.8725 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.2861	45.6666	47.1888	49.2861	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (64)
	68.5473	60.3165	63.1070	56.2401	54.4555	47.7751	45.4886	50.9829	51.4519	58.3340	62.0985	66.7864 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	92.1335	89.7568	84.8212	78.1113	73.1929	66.3543	61.1407	68.5255	71.4610	78.4059	86.2479	89.7667	(72)
Total internal gains	486.0943	483.6504	466.2993	438.1522	408.5190	380.3102	362.7972	370.2491	385.6002	413.9823	446.5392	471.4281	(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				10.0700	10.6334	0.6300	0.7000	0.7700		32.7245 (74)			
South				8.1100	46.7521	0.6300	0.7000	0.7700		115.8760 (78)			
West				0.6000	19.6403	0.6300	0.7000	0.7700		3.6014 (80)			
Solar gains	152.2019	259.3583	359.6097	460.8327	535.3873	541.3805	517.7392	459.6758	393.7878	287.4933	182.2130	130.3699	(83)
Total gains	638.2962	743.0088	825.9090	898.9849	943.9063	921.6907	880.5364	829.9249	779.3880	701.4757	628.7521	601.7980	(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	62.6565	62.8040	62.9492	63.6405	63.7715	64.3886	64.3886	64.5042	64.1495	63.7715	63.5070	63.2328	
alpha	5.1771	5.1869	5.1966	5.2427	5.2514	5.2926	5.2926	5.3003	5.2766	5.2514	5.2338	5.2155	
util living area	0.9992	0.9981	0.9948	0.9831	0.9420	0.8261	0.6606	0.7148	0.9151	0.9888	0.9982	0.9994	(86)
MIT	19.7164	19.8589	20.0883	20.3972	20.6930	20.9050	20.9777	20.9665	20.8156	20.4353	20.0195	19.6929	(87)
Th 2	19.9940	19.9962	19.9982	20.0080	20.0099	20.0184	20.0184	20.0200	20.0151	20.0099	20.0062	20.0023	(88)
util rest of house	0.9989	0.9974	0.9929	0.9759	0.9146	0.7461	0.5302	0.5881	0.8639	0.9828	0.9975	0.9992	(89)
MIT 2	18.2684	18.4783	18.8145	19.2686	19.6823	19.9472	20.0092	20.0043	19.8505	19.3281	18.7206	18.2399	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.4454	18.6470	18.9702	19.4065	19.8058	20.0642	20.1275	20.1219	19.9685	19.4634	18.8794	18.4174	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4454	18.6470	18.9702	19.4065	19.8058	20.0642	20.1275	20.1219	19.9685	19.4634	18.8794	18.4174	(93)

8. Space heating requirement

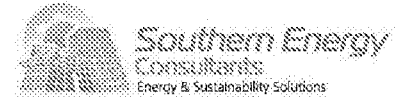
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9959	0.9899	0.9698	0.9074	0.7504	0.5457	0.6025	0.8609	0.9779	0.9961	0.9987	(94)
Ext temp.	637.1784	739.9903	817.5303	871.8123	856.5086	691.6645	480.5414	500.0673	670.9634	685.9786	626.3271	601.0221	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2021.8095	1960.2564	1774.0827	1478.4825	1138.3142	759.9971	490.6287	516.7368	819.2626	1244.7090	1661.0868	2013.5921	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1030.1655	820.0188	711.6750	436.8025	209.6634	0.0000	0.0000	0.0000	0.0000	415.6955	745.0269	1050.9521	(98)
Space heating per m2												5419.9997	(98)
										(98) / (4) =		42.0285	(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

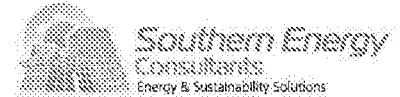
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5802.9975 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1030.1655	820.0188	711.6750	436.8025	209.6634	0.0000	0.0000	0.0000	0.0000	415.6955	745.0269	1050.9521 (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)	1102.9609	877.9644	761.9647	467.6687	224.4790	0.0000	0.0000	0.0000	0.0000	445.0701	797.6734	1125.2164 (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	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (64)
Efficiency of water heater (217)m	88.4510	88.2859	87.9502	87.1826	85.4927	80.3000	80.3000	80.3000	80.3000	86.9915	88.0651	80.3000 (216)
Fuel for water heating, kWh/month	247.3701	218.4079	230.1750	208.0454	205.8714	193.0452	184.9520	206.1782	207.9436	216.2101	225.9675	241.1944 (219)
Water heating fuel used												2585.3608 (219)
Annual totals kWh/year												
Space heating fuel - main system												5802.9975 (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)												496.5096 (232)
Total delivered energy for all uses												8959.8679 (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	5802.9975	0.2160	1253.4475 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2585.3608	0.2160	558.4379 (264)
Space and water heating			1811.8854 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total CO2, kg/m2/year			2108.4989 (272)
Emissions per m2 for space and water heating			14.0500 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9982 (272b)
Emissions per m2 for pumps and fans			0.3018 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0500 * 1.00) + 1.9982 + 0.3018, rounded to 2 d.p.			16.3500 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			9.0000	580.3200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23314.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.7902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss							(33) + (36) = 92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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	2.8922 (42)
Average daily hot water use (litres/day)	102.8908 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 = 1618.8725 (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	35.6665	31.1942	32.1896	28.0637	26.9278	23.2366	21.5321	24.7084	25.0035	29.1392	31.8077	34.5411 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	47.9389	46.4199	43.2656	38.9773	36.1932	32.2731	28.9410	33.2103	34.7271	39.1656	44.1774	46.4262	(72)
Total internal gains	438.8996	437.3136	421.7437	396.0182	368.5193	343.2289	327.5976	331.9339	345.8663	371.7420	401.4687	425.0877	(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			10.0700	10.6334		0.4400		0.0000		0.7700		36.2781 (74)
South			8.1100	46.7521		0.4400		0.0000		0.7700		128.4592 (78)
West			0.6000	19.6403		0.4400		0.0000		0.7700		3.9925 (80)
Solar gains	168.7297	287.5224	398.6603	510.8753	593.5259	600.1699	573.9613	509.5927	436.5498	318.7127	201.9998	144.5270 (83)
Total gains	607.6294	724.8360	820.4040	906.8935	962.0451	943.3988	901.5589	841.5266	782.4161	690.4547	603.4684	569.6146 (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	42.5205	42.6144	42.7069	43.1465	43.2298	43.6217	43.6217	43.6951	43.4699	43.2298	43.0617	42.8873
alpha	3.8347	3.8410	3.8471	3.8764	3.8820	3.9081	3.9081	3.9130	3.8980	3.8820	3.8708	3.8592
util living area	0.9969	0.9934	0.9858	0.9649	0.9121	0.7991	0.6532	0.7055	0.8882	0.9759	0.9942	0.9976 (86)
MIT	19.2063	19.4008	19.7118	20.1254	20.5204	20.8170	20.9401	20.9178	20.6899	20.1779	19.6156	19.1735 (87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433 (88)
util rest of house	0.9960	0.9917	0.9817	0.9539	0.8813	0.7236	0.5273	0.5852	0.8367	0.9664	0.9924	0.9969 (89)
MIT 2	18.2912	18.4865	18.7971	19.2117	19.5898	19.8538	19.9375	19.9279	19.7532	19.2687	18.7088	18.2645 (90)
Living area fraction	18.4030	18.5982	18.9089	19.3234	19.7035	19.9716	20.0600	20.0489	19.8677	19.3798	18.8196	18.3756 (91)
MIT	18.4030	18.5982	18.9089	19.3234	19.7035	19.9716	20.0600	20.0489	19.8677	19.3798	18.8196	18.3756 (92)
Temperature adjustment	18.4030	18.5982	18.9089	19.3234	19.7035	19.9716	20.0600	20.0489	19.8677	19.3798	18.8196	18.3756 (93)
adjusted MIT	18.4030	18.5982	18.9089	19.3234	19.7035	19.9716	20.0600	20.0489	19.8677	19.3798	18.8196	18.3756 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	604.1839	716.5739	801.0781	857.3927	839.2612	683.5968	487.5055	502.1559	650.4546	662.3724	597.1711	567.0850	(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	2148.0337	2081.7810	1881.7513	1564.5530	1199.0211	797.4894	513.6896	540.8193	859.2869	1315.3151	1762.5828	2140.6258	(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	1148.6242	917.4192	804.0208	509.1554	267.6614	0.0000	0.0000	0.0000	0.0000	485.7894	839.0964	1170.7144	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 47.6309 (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	1395.5736	1098.6430	1126.4419	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7402	0.8206	0.7878	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1032.9903	901.4993	887.4006	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1221.6689	1170.1335	1102.4338	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	135.8486	199.8639	159.9847	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												495.6972 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	33.9621	49.9660	39.9962	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												123.9243 (107)
Space cooling per m2												0.9610 (108)
Energy for space heating												47.6309 (99)
Energy for space cooling												0.9610 (108)
Total												48.5919 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.6 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.3258	24.8977		(27)
Heat Loss Floor 1			64.4800	0.1300	8.3824		(28a)
Brick Cavity	120.4500	19.7100	100.7400	0.1800	18.1332		(29a)
Clad Cavity	36.8100	3.3700	33.4400	0.1800	6.0192		(29a)
Main Plane	64.4800		64.4800	0.1300	8.3824		(30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.5449		(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)							12.3550 (36)
Total fabric heat loss						(33) + (36) =	82.8999 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	142.9310	142.5953	142.2663	140.7210	140.4319	139.0860	139.0860	138.8368	139.6044	140.4319	141.0168	141.6283 (39)
Average = Sum(39)m / 12 =												140.7196 (39)
HLP	1.1083	1.1057	1.1032	1.0912	1.0890	1.0785	1.0785	1.0766	1.0825	1.0890	1.0935	1.0982 (40)
HLP (average)												1.0912 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)
Energy content (annual)										Total = Sum(45)m =		1618.8725 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.6665	31.1942	32.1896	28.0637	26.9278	23.2366	21.5321	24.7084	25.0035	29.1392	31.8077	34.5411 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	47.9389	46.4199	43.2656	38.9773	36.1932	32.2731	28.9410	33.2103	34.7271	39.1656	44.1774	46.4262	(72)
Total internal gains	438.8996	437.3136	421.7437	396.0182	368.5193	343.2289	327.5976	331.9339	345.8663	371.7420	401.4687	425.0877	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	10.0700	10.6334	0.6300		0.7000	0.7700	32.7245 (74)
South	8.1100	46.7521	0.6300		0.7000	0.7700	115.8760 (78)
West	0.6000	19.6403	0.6300		0.7000	0.7700	3.6014 (80)

Solar gains	152.2019	259.3583	359.6097	460.8327	535.3873	541.3805	517.7392	459.6758	393.7878	287.4933	182.2130	130.3699	(83)
Total gains	591.1015	696.6719	781.3534	856.8509	903.9066	884.6095	845.3368	791.6097	739.6541	659.2353	583.6816	555.4576	(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	62.6565	62.8040	62.9492	63.6405	63.7715	64.3886	64.3886	64.5042	64.1495	63.7715	63.5070	63.2328	
alpha	5.1771	5.1869	5.1966	5.2427	5.2514	5.2926	5.2926	5.3003	5.2766	5.2514	5.2338	5.2155	
util living area	0.9995	0.9986	0.9960	0.9862	0.9505	0.8437	0.6823	0.7394	0.9288	0.9915	0.9988	0.9996	(86)
MIT	19.6819	19.8252	20.0564	20.3686	20.6709	20.8939	20.9740	20.9606	20.7963	20.4058	19.9866	19.6589	(87)
Th 2	19.9940	19.9962	19.9982	20.0080	20.0099	20.0184	20.0184	20.0200	20.0151	20.0099	20.0062	20.0023	(88)
util rest of house	0.9993	0.9981	0.9944	0.9802	0.9261	0.7669	0.5504	0.6128	0.8831	0.9868	0.9982	0.9995	(89)
MIT 2	18.7814	18.9262	19.1584	19.4756	19.7669	19.9629	20.0109	20.0071	19.8879	19.5158	19.0957	18.7650	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.8914	19.0361	19.2682	19.5848	19.8774	20.0767	20.1286	20.1236	19.9989	19.6246	19.2046	18.8743	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8914	19.0361	19.2682	19.5848	19.8774	20.0767	20.1286	20.1236	19.9989	19.6246	19.2046	18.8743	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9990	0.9974	0.9929	0.9768	0.9220	0.7722	0.5664	0.6276	0.8822	0.9842	0.9976	0.9992	(94)
Ext temp.	590.4816	694.8261	775.7688	836.9300	833.3680	683.0994	478.8090	496.8524	652.5050	648.8395	582.2827	555.0398	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2085.5685	2015.7400	1816.4806	1503.5697	1148.3680	761.7295	490.7810	516.9730	823.5130	1267.3353	1706.9469	2078.2929	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	1112.3447	887.6541	774.2896	479.9806	234.3600	0.0000	0.0000	0.0000	0.0000	460.1609	809.7582	1133.3003	(98)
												5891.8484	(98)
												45.6874	(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	1307.4084	1029.2364	1055.1593	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7839	0.8692	0.8368	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1024.8633	894.5900	882.9650	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1152.9541	1104.4193	1044.0893	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

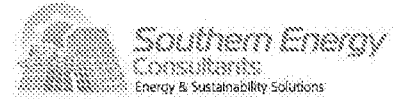


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	92.2254	156.1130	119.8765	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												368.2149 (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	23.0563	39.0283	29.9691	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												92.0537 (107)
Space cooling per m2												0.7138 (108)
Energy for space heating												45.6874 (99)
Energy for space cooling												0.7138 (108)
Total												46.4012 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.5287	148.9837	148.9837	148.2160	148.2160	147.2855	147.5082	147.0695	147.2855	147.7375	147.7375	148.4653 (39)
Average = Sum(39)m / 12 =												148.0848 (39)
HLP	1.1595	1.1553	1.1553	1.1493	1.1493	1.1421	1.1438	1.1404	1.1421	1.1456	1.1456	1.1513 (40)
HLP (average)												1.1483 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

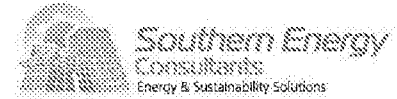
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(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					10.0700	11.9814	0.4400	0.0000	0.7700		40.8773 (74)	
South					8.1100	50.9848	0.4400	0.0000	0.7700		140.0894 (78)	
West					0.6000	22.3313	0.4400	0.0000	0.7700		4.5395 (80)	
Solar gains	185.5061	284.8070	391.8987	521.6992	594.2261	644.5977	609.1724	550.4070	466.5592	337.5210	227.5675	157.3475 (83)
Total gains	894.1325	987.7853	1066.7038	1152.8161	1180.1769	1190.7010	1132.4834	1083.6801	1025.4418	940.3272	879.0285	846.0328 (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	44.3895	44.5519	44.5519	44.7827	44.7827	45.0656	44.9976	45.1318	45.0656	44.9277	44.9277	44.7075
alpha	3.9593	3.9701	3.9701	3.9855	3.9855	4.0044	3.9998	4.0088	4.0044	3.9952	3.9952	3.9805
util living area	0.9869	0.9796	0.9613	0.9126	0.8013	0.5806	0.3973	0.4255	0.7214	0.9207	0.9756	0.9891 (86)
MIT	19.6341	19.7867	20.0848	20.4569	20.7802	20.9586	20.9933	20.9912	20.8949	20.5207	20.0257	19.6052 (87)
Th 2	19.9525	19.9560	19.9560	19.9608	19.9608	19.9666	19.9652	19.9680	19.9666	19.9638	19.9638	19.9592 (88)
util rest of house	0.9835	0.9744	0.9508	0.8874	0.7424	0.4758	0.2680	0.2927	0.6289	0.8922	0.9682	0.9863 (89)
MIT 2	18.1575	18.3804	18.8088	19.3329	19.7522	19.9428	19.9636	19.9657	19.8898	19.4312	18.7335	18.1203 (90)
Living area fraction	fLA = Living area / (4) =											0.1222 (91)
MIT	18.3379	18.5522	18.9647	19.4703	19.8778	20.0670	20.0895	20.0910	20.0127	19.5644	18.8914	18.3018 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1879	18.4022	18.8147	19.3203	19.7278	19.9170	19.9395	19.9410	19.8627	19.4144	18.7414	18.1518 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9632	0.9351	0.8679	0.7271	0.4704	0.2647	0.2891	0.6184	0.8725	0.9556	0.9789	(94)
Useful gains	871.8284	951.4675	997.4754	1000.5730	858.1596	560.1284	299.7357	313.3027	634.1175	820.4743	839.9646	828.1413	(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	1957.0193	1907.3242	1700.6114	1396.2343	997.1727	576.9124	300.8375	314.8811	686.7421	1154.4761	1586.9145	1937.7344	(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	807.3820	642.3357	523.1331	284.8761	103.4258	0.0000	0.0000	0.0000	0.0000	248.4973	537.8039	825.5373	(98)
Space heating												3972.9913	(98)
RHI space heating demand												3973	(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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 =	1618.8725 (45)
Distribution loss (46)m = 0.15 x (45)m													
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720	14.1467 (61)	
Total heat required for water heating calculated for each month													
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (62)		
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)		
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)		
								Total per year (kWh/year) = Sum(64)m =					1784.6736 (64)
Heat gains from water heating, kWh/month													
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(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				10.0700	10.6334	0.4400	0.0000	0.7700	36.2781 (74)				
South				8.1100	46.7521	0.4400	0.0000	0.7700	128.4592 (78)				
West				0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)				
Solar gains	168.7297	287.5224	398.6603	510.8753	593.5259	600.1699	573.9613	509.5927	436.5498	318.7127	201.9998	144.5270	(83)
Total gains	877.3561	990.5007	1073.4654	1141.9922	1179.4767	1146.2732	1097.2723	1042.8658	995.4324	921.5189	853.4607	833.2122	(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	43.5789	43.6751	43.7699	44.2205	44.3058	44.7075	44.7075	44.7827	44.5519	44.3058	44.1335	43.9548	
alpha	3.9053	3.9117	3.9180	3.9480	3.9537	3.9805	3.9805	3.9855	3.9701	3.9537	3.9422	3.9303	
util living area	0.9897	0.9825	0.9682	0.9339	0.8586	0.7183	0.5623	0.6065	0.8114	0.9447	0.9825	0.9915	(86)
MIT	19.4769	19.6595	19.9446	20.3157	20.6525	20.8839	20.9668	20.9548	20.7986	20.3722	19.8579	19.4411	(87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433	(88)
util rest of house	0.9871	0.9781	0.9599	0.9152	0.8164	0.6349	0.4436	0.4889	0.7430	0.9253	0.9773	0.9894	(89)
MIT 2	17.9174	18.1833	18.5960	19.1292	19.5854	19.8681	19.9431	19.9368	19.7781	19.2176	18.4800	17.8706	(90)
Living area fraction	18.1080	18.3637	18.7609	19.2742	19.7159	19.9923	20.0682	20.0612	19.9028	19.3587	18.6484	18.0626	(91)
MIT	17.9580	18.2137	18.6109	19.1242	19.5659	19.8423	19.9182	19.9112	19.7528	19.2087	18.4984	17.9126	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	859.6799	958.6172	1014.8865	1023.5725	940.9446	715.6887	481.2202	503.5587	723.8734	835.6217	825.1485	819.1456	(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	2080.2488	2023.3391	1836.5575	1534.6527	1178.3927	778.2950	492.6345	520.4176	842.1710	1289.6793	1714.2769	2070.6988	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	908.1032	715.4932	611.3232	367.9777	176.6614	0.0000	0.0000	0.0000	0.0000	337.8189	640.1725	931.1556	(98)
Space heating												4688.7057	(98)
Space heating per m2												(98) / (4) =	36.3578 (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													5180.8903	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	908.1032	715.4932	611.3232	367.9777	176.6614	0.0000	0.0000	0.0000	0.0000	337.8189	640.1725	931.1556	(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)	1003.4290	790.6002	675.4953	406.6052	195.2059	0.0000	0.0000	0.0000	0.0000	373.2806	707.3729	1028.9012	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	89.9495	89.8991	89.7984	89.5688	89.0524	87.3000	87.3000	87.3000	87.3000	89.4858	89.8306	89.9740	(217)	
Fuel for water heating, kWh/month	202.3377	177.5031	184.4137	162.6616	158.0749	140.7841	132.0841	149.2571	150.3538	168.9781	181.8483	196.3824	(219)	
Water heating fuel used												2004.6789	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5180.8903	(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)													496.5096	(232)
Total delivered energy for all uses													7757.0787	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5180.8903	3.4800	180.2950 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.6789	3.4800	69.7628 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	496.5096	13.1900	65.4896 (250)
Additional standing charges			120.0000 (251)
Total energy cost			445.4399 (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] =	1.0754 (257)
SAP value		84.9975
SAP rating (Section 12)		85 (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	5180.8903	0.2160	1119.0723 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.6789	0.2160	433.0106 (264)
Space and water heating			1552.0829 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1848.6964 (272)
CO2 emissions per m2			14.3400 (273)
EI value			85.7596
EI rating			86 (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	$3.48 / 0.8890 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8890 = 0.2430$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

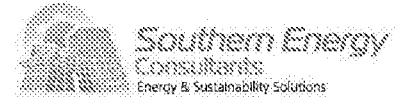
Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of EPC Costs, Emissions and Primary Energy 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
Calculation of EPC Costs, Emissions and Primary Energy 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss							(33) + (36) = 92.2792 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.5287	148.9837	148.9837	148.2160	148.2160	147.2855	147.5082	147.0695	147.2855	147.7375	147.7375	148.4653 (39)
Average = Sum(39)m / 12 =												148.0848 (39)
HLP	1.1595	1.1553	1.1553	1.1493	1.1493	1.1421	1.1438	1.1404	1.1421	1.1456	1.1456	1.1513 (40)
HLP (average)												1.1483 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (65)
Total per year (kWh/year) = Sum(64)m =	1784.6736 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(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					10.0700	11.9814	0.4400	0.0000	0.7700		40.8773 (74)	
South					8.1100	50.9848	0.4400	0.0000	0.7700		140.0894 (78)	
West					0.6000	22.3313	0.4400	0.0000	0.7700		4.5395 (80)	
Solar gains	185.5061	284.8070	391.8987	521.6992	594.2261	644.5977	609.1724	550.4070	466.5592	337.5210	227.5675	157.3475 (83)
Total gains	894.1325	987.7853	1066.7038	1152.8161	1180.1769	1190.7010	1132.4834	1083.6801	1025.4418	940.3272	879.0285	846.0328 (84)

7. Mean internal temperature (heating season)

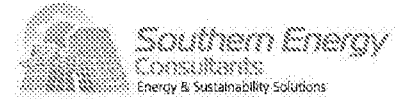
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.3895	44.5519	44.5519	44.7827	44.7827	45.0656	44.9976	45.1318	45.0656	44.9277	44.9277	44.7075
alpha	3.9593	3.9701	3.9701	3.9855	3.9855	4.0044	3.9998	4.0088	4.0044	3.9952	3.9952	3.9805
util living area	0.9869	0.9796	0.9613	0.9126	0.8013	0.5806	0.3973	0.4255	0.7214	0.9207	0.9756	0.9891 (86)
MIT	19.6341	19.7867	20.0848	20.4569	20.7802	20.9586	20.9933	20.9912	20.8949	20.5207	20.0257	19.6052 (87)
Th 2	19.9525	19.9560	19.9560	19.9608	19.9608	19.9666	19.9652	19.9680	19.9666	19.9638	19.9638	19.9592 (88)
util rest of house	0.9835	0.9744	0.9508	0.8874	0.7424	0.4758	0.2680	0.2927	0.6289	0.8922	0.9682	0.9863 (89)
MIT 2	18.1575	18.3804	18.8088	19.3329	19.7522	19.9428	19.9636	19.9657	19.8898	19.4312	18.7335	18.1203 (90)
Living area fraction	18.3379	18.5522	18.9647	19.4703	19.8778	20.0670	20.0895	20.0910	20.0127	19.5644	18.8914	18.3018 (91)
MIT	18.1879	18.4022	18.8147	19.3203	19.7278	19.9170	19.9395	19.9410	19.8627	19.4144	18.7414	18.1518 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1879	18.4022	18.8147	19.3203	19.7278	19.9170	19.9395	19.9410	19.8627	19.4144	18.7414	18.1518 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	871.8284	951.4675	997.4754	1000.5730	858.1596	560.1284	299.7357	313.3027	634.1175	820.4743	839.9646	828.1413	(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	1957.0193	1907.3242	1700.6114	1396.2343	997.1727	576.9124	300.8375	314.8811	686.7421	1154.4761	1586.9145	1937.7344	(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	807.3820	642.3357	523.1331	284.8761	103.4258	0.0000	0.0000	0.0000	0.0000	248.4973	537.8039	825.5373	(98)
Space heating												3972.9913	(98)
Space heating per m2												(98) / (4) = 30.8079	(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													4390.0457 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	807.3820	642.3357	523.1331	284.8761	103.4258	0.0000	0.0000	0.0000	0.0000	248.4973	537.8039	825.5373	(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)	892.1349	709.7632	578.0477	314.7803	114.2826	0.0000	0.0000	0.0000	0.0000	274.5826	594.2585	912.1959	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.8939	89.8447	89.7094	89.3913	88.6273	87.3000	87.3000	87.3000	87.3000	89.2622	89.7337	89.9189	(217)
Fuel for water heating, kWh/month	202.4630	177.6106	184.5967	162.9847	158.8332	140.7841	132.0841	149.2571	150.3538	169.4012	182.0447	196.5027	(219)
Water heating fuel used												2006.9159	(219)
Annual totals kWh/year													
Space heating fuel - main system												4390.0457	(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)												496.5096	(232)
Total delivered energy for all uses												6968.4712	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4390.0457	3.8700	169.8948 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2006.9159	3.8700	77.6676 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	496.5096	18.9000	93.8403 (250)
Additional standing charges			93.0000 (251)
Total energy cost			448.5777 (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	4390.0457	0.2160	948.2499 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9159	0.2160	433.4938 (264)
Space and water heating			1381.7437 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1678.3572 (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	4390.0457	1.2200	5355.8557 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9159	1.2200	2448.4374 (264)
Space and water heating			7804.2932 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	496.5096	3.0700	1524.2844 (268)
Primary energy kWh/year			9558.8276 (272)
Primary energy kWh/m2/year			74.1224 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
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
U Solar photovoltaic panels	+ 7.7	-£ 345	-947 kg (56.4%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.9	-£ 30	-193 kg (11.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£345	7.34 kg/m²	A 93
Total Savings	£345	7.34 kg/m²	A 93
Potential energy efficiency rating:		A 93	
Potential environmental impact rating:			A 93

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	£108	£108	£0
Mains gas	£341	£341	£0
Space heating	£277	£277	£0
Water heating	£78	£78	£0
Lighting	£94	£94	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£449	£104	£345
Total cost of uses	£449	£104	£345
Delivered energy	54 kWh/m²	40 kWh/m²	14 kWh/m²
Carbon dioxide emissions	1.7 tonnes	0.7 tonnes	0.9 tonnes
CO2 emissions per m²	13 kg/m²	6 kg/m²	7 kg/m²
Primary energy	74 kWh/m²	31 kWh/m²	43 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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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	2.8922 (42)
Average daily hot water use (litres/day)	102.8908 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

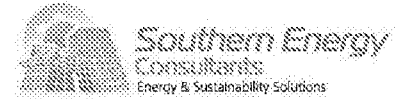
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(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				10.0700	10.6334	0.4400	0.0000			0.7700			36.2781 (74)
South				8.1100	46.7521	0.4400	0.0000			0.7700			128.4592 (78)
West				0.6000	19.6403	0.4400	0.0000			0.7700			3.9925 (80)
Solar gains	168.7297	287.5224	398.6603	510.8753	593.5259	600.1699	573.9613	509.5927	436.5498	318.7127	201.9998	144.5270	(83)
Total gains	877.3561	990.5007	1073.4654	1141.9922	1179.4767	1146.2732	1097.2723	1042.8658	995.4324	921.5189	853.4607	833.2122	(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	43.5789	43.6751	43.7699	44.2205	44.3058	44.7075	44.7075	44.7827	44.5519	44.3058	44.1335	43.9548	
alpha	3.9053	3.9117	3.9180	3.9480	3.9537	3.9805	3.9805	3.9855	3.9701	3.9537	3.9422	3.9303	
util living area	0.9897	0.9825	0.9682	0.9339	0.8586	0.7183	0.5623	0.6065	0.8114	0.9447	0.9825	0.9915	(86)
MIT	19.4769	19.6595	19.9446	20.3157	20.6525	20.8839	20.9668	20.9548	20.7986	20.3722	19.8579	19.4411	(87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433	(88)
util rest of house	0.9871	0.9781	0.9599	0.9152	0.8164	0.6349	0.4436	0.4889	0.7430	0.9253	0.9773	0.9894	(89)
MIT 2	17.9174	18.1833	18.5960	19.1292	19.5854	19.8681	19.9431	19.9368	19.7781	19.2176	18.4800	17.8706	(90)
Living area fraction	18.1080	18.3637	18.7609	19.2742	19.7159	19.9923	20.0682	20.0612	19.9028	19.3587	18.6484	18.0626	(91)
MIT	17.9580	18.2137	18.6109	19.1242	19.5659	19.8423	19.9182	19.9112	19.7528	19.2087	18.4984	17.9126	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9799	0.9678	0.9454	0.8963	0.7978	0.6244	0.4386	0.4829	0.7272	0.9068	0.9668	0.9831	(94)	
Useful gains	859.6799	958.6172	1014.8865	1023.5725	940.9446	715.6887	481.2202	503.5587	723.8734	835.6217	825.1485	819.1456	(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	2080.2488	2023.3391	1836.5575	1534.6527	1178.3927	778.2950	492.6345	520.4176	842.1710	1289.6793	1714.2769	2070.6988	(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	908.1032	715.4932	611.3232	367.9777	176.6614	0.0000	0.0000	0.0000	0.0000	337.8189	640.1725	931.1556	(98)	
Space heating												4688.7057	(98)	
Space heating per m2												(98) / (4) =	36.3578	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 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													5180.8903 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	908.1032	715.4932	611.3232	367.9777	176.6614	0.0000	0.0000	0.0000	0.0000	337.8189	640.1725	931.1556	(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)	1003.4290	790.6002	675.4953	406.6052	195.2059	0.0000	0.0000	0.0000	0.0000	373.2806	707.3729	1028.9012	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9495	89.8991	89.7984	89.5688	89.0524	87.3000	87.3000	87.3000	87.3000	89.4858	89.8306	89.9740	(217)
Fuel for water heating, kWh/month	202.3377	177.5031	184.4137	162.6616	158.0749	140.7841	132.0841	149.2571	150.3538	168.9781	181.8483	196.3824	(219)
Water heating fuel used												2004.6789	(219)
Annual totals kWh/year													
Space heating fuel - main system												5180.8903	(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)												496.5096	(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												6029.8393	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5180.8903	3.4800	180.2950 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.6789	3.4800	69.7628 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	496.5096	13.1900	65.4896 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			217.6170 (255)

11a. SAP rating - Individual heating systems

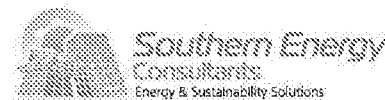
Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5254 (257)
SAP value		92.6706
SAP rating (Section 12)		93 (258)
SAP band		A

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	5180.8903	0.2160	1119.0723 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.6789	0.2160	433.0106 (264)
Space and water heating			1552.0829 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			952.2592 (272)
CO2 emissions per m2			7.3800 (273)
EI value			92.6648
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Clad Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.5287	148.9837	148.9837	148.2160	148.2160	147.2855	147.5082	147.0695	147.2855	147.7375	147.7375	148.4653 (39)
Average = Sum(39)m / 12 =												148.0848 (39)
HLP	1.1595	1.1553	1.1553	1.1493	1.1493	1.1421	1.1438	1.1404	1.1421	1.1456	1.1456	1.1513 (40)
HLP (average)												1.1483 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(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					10.0700	11.9814	0.4400	0.0000	0.7700	40.8773 (74)		
South					8.1100	50.9848	0.4400	0.0000	0.7700	140.0894 (78)		
West					0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (80)		
Solar gains	185.5061	284.8070	391.8987	521.6992	594.2261	644.5977	609.1724	550.4070	466.5592	337.5210	227.5675	157.3475 (83)
Total gains	894.1325	987.7853	1066.7038	1152.8161	1180.1769	1190.7010	1132.4834	1083.6801	1025.4418	940.3272	879.0285	846.0328 (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	44.3895	44.5519	44.5519	44.7827	44.7827	45.0656	44.9976	45.1318	45.0656	44.9277	44.9277	44.7075
alpha	3.9593	3.9701	3.9701	3.9855	3.9855	4.0044	3.9998	4.0088	4.0044	3.9952	3.9952	3.9805
util living area	0.9869	0.9796	0.9613	0.9126	0.8013	0.5806	0.3973	0.4255	0.7214	0.9207	0.9756	0.9891 (86)
MIT	19.6341	19.7867	20.0848	20.4569	20.7802	20.9586	20.9933	20.9912	20.8949	20.5207	20.0257	19.6052 (87)
Th 2	19.9525	19.9560	19.9560	19.9608	19.9608	19.9666	19.9652	19.9680	19.9666	19.9638	19.9638	19.9592 (88)
util rest of house	0.9835	0.9744	0.9508	0.8874	0.7424	0.4758	0.2680	0.2927	0.6289	0.8922	0.9682	0.9863 (89)
MIT 2	18.1575	18.3804	18.8088	19.3329	19.7522	19.9428	19.9636	19.9657	19.8898	19.4312	18.7335	18.1203 (90)
Living area fraction	18.3379	18.5522	18.9647	19.4703	19.8778	20.0670	20.0895	20.0910	20.0127	19.5644	18.8914	18.3018 (91)
MIT	18.1879	18.4022	18.8147	19.3203	19.7278	19.9170	19.9395	19.9410	19.8627	19.4144	18.7414	18.1518 (92)
Temperature adjustment												-0.1500
adjusted MIT												18.1518 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	871.8284	951.4675	997.4754	1000.5730	858.1596	560.1284	299.7357	313.3027	634.1175	820.4743	839.9646	828.1413	(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	1957.0193	1907.3242	1700.6114	1396.2343	997.1727	576.9124	300.8375	314.8811	686.7421	1154.4761	1586.9145	1937.7344	(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	807.3820	642.3357	523.1331	284.8761	103.4258	0.0000	0.0000	0.0000	0.0000	248.4973	537.8039	825.5373	(98)
Space heating												3972.9913	(98)
Space heating per m2												(98) / (4) = 30.8079	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Calculation of EPC Costs, Emissions and Primary Energy for Improved Dwelling 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													4390.0457	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	807.3820	642.3357	523.1331	284.8761	103.4258	0.0000	0.0000	0.0000	0.0000	248.4973	537.8039	825.5373	(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)	892.1349	709.7632	578.0477	314.7803	114.2826	0.0000	0.0000	0.0000	0.0000	274.5826	594.2585	912.1959	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	89.8939	89.8447	89.7094	89.3913	88.6273	87.3000	87.3000	87.3000	87.3000	89.2622	89.7337	89.9189	(217)	
Fuel for water heating, kWh/month	202.4630	177.6106	184.5967	162.9847	158.8332	140.7841	132.0841	149.2571	150.3538	169.4012	182.0447	196.5027	(219)	
Water heating fuel used												2006.9159	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4390.0457	(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)													496.5096	(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													5144.3116	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4390.0457	3.8700	169.8948 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2006.9159	3.8700	77.6676 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	496.5096	18.9000	93.8403 (250)
Additional standing charges			93.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	18.9000	-344.7662 (252)
Total energy cost			103.8116 (255)

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

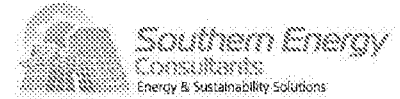
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4390.0457	0.2160	948.2499 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9159	0.2160	433.4938 (264)
Space and water heating			1381.7437 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			731.6183 (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	4390.0457	1.2200	5355.8557 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9159	1.2200	2448.4374 (264)
Space and water heating			7804.2932 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	496.5096	3.0700	1524.2844 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			3958.6575 (272)
Primary energy kWh/m2/year			30.6968 (273)

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 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	185.3 (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	411.10 (P1)
Transmission heat loss coefficient	92.28 (37)
Summer heat loss coefficient	503.38 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
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	10.0700	81.1852	0.4400	0.0000	0.9000	323.7437
South	8.1100	112.2060	0.4400	0.0000	0.9000	360.3563
West	0.6000	117.5071	0.4400	0.0000	0.9000	27.9197
total:						712.0197

	Jun	Jul	Aug	
Solar gains	753	712	643	(P4)
Internal gains	543	520	530	
Total summer gains	1297	1232	1174	(P5)
Summer gain/loss ratio	2.58	2.45	2.33	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 185.3)	0.70	0.70	0.70	
Threshold temperature	19.28	21.05	20.83	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			