

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG001b		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Th Ea Ga		
Property	Holywell, Plot 20				
SAP Rating	85 B	DER	15.92	TET	16.39
Environmental	36 B	% DER<TER	2.85		
CO ₂ Emissions (t/year)	1.68	DPEE	48.98	TPEE	53.74
General Requirements Compliance	Pass	% DPEE<TPEE	8.85		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 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) 16.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing South East: 8.11 m², No overhang
Windows facing South West: 0.60 m², No overhang
Windows facing North West: 10.07 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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) = 92.2947 (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	152.3257	151.9901	151.6611	150.1158	149.8267	148.4808	148.4808	148.2315	148.9992	149.8267	150.4116	151.0230 (39)
Average = Sum(39)m / 12 =												150.1144 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1812	1.1786	1.1760	1.1640	1.1618	1.1514	1.1514	1.1494	1.1554	1.1618	1.1663	1.1711 (40)
HLP (average)												1.1640 (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

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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	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	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
Southeast	8.1100	36.7938	0.4400	0.0000	0.7700	101.0972 (77)
Southwest	0.6000	36.7938	0.4400	0.0000	0.7700	7.4795 (79)
Northwest	10.0700	11.2829	0.4400	0.0000	0.7700	38.4942 (81)

Solar gains	147.0709	263.3023	394.2242	545.3892	662.8410	680.9031	646.9519	555.8333	446.0224	300.1623	178.4855	124.3553 (83)
Total gains	620.7997	734.5830	848.1449	971.1507	1059.5202	1050.0637	998.5908	914.2345	819.2199	701.7544	612.6486	583.4137 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	43.5744	43.6707	43.7654	44.2159	44.3012	44.7028	44.7028	44.7780	44.5473	44.3012	44.1290	43.9503
alpha	3.9050	3.9114	3.9177	3.9477	3.9534	3.9802	3.9802	3.9852	3.9698	3.9534	3.9419	3.9300
util living area	0.9969	0.9937	0.9852	0.9589	0.8907	0.7575	0.6067	0.6691	0.8781	0.9761	0.9944	0.9976 (86)
MIT	19.2500	19.4380	19.7589	20.1921	20.5894	20.8582	20.9565	20.9358	20.7177	20.2026	19.6486	19.2184 (87)
Th 2	19.9351	19.9372	19.9392	19.9489	19.9507	19.9591	19.9591	19.9607	19.9559	19.9507	19.9470	19.9432 (88)
util rest of house	0.9961	0.9920	0.9809	0.9461	0.8546	0.6765	0.4832	0.5481	0.8231	0.9665	0.9926	0.9970 (89)
MIT 2	17.5873	17.8630	18.3312	18.9599	19.5083	19.8447	19.9373	19.9248	19.6904	18.9840	18.1778	17.5463 (90)
Living area fraction	17.7905	18.0555	18.5057	19.1105	19.6405	19.9685	20.0619	20.0484	19.8159	19.1330	18.3575	17.7507 (92)
MIT	17.7905	18.0555	18.5057	19.1105	19.6405	19.9685	20.0619	20.0484	19.8159	19.1330	18.3575	17.7507 (92)
Temperature adjustment	17.6405	17.9055	18.3557	18.9605	19.4905	19.8185	19.9119	19.8984	19.6659	18.9830	18.2075	17.6007 (93)
adjusted MIT	17.6405	17.9055	18.3557	18.9605	19.4905	19.8185	19.9119	19.8984	19.6659	18.9830	18.2075	17.6007 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9932	0.9868	0.9715	0.9296	0.8348	0.6639	0.4771	0.5400	0.8037	0.9532	0.9878	0.9946 (94)
Useful gains	616.5838	724.8972	823.9451	902.8023	884.4896	697.1813	476.4121	493.6690	658.3663	668.9094	605.1595	580.2786 (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	2032.0962	1976.7009	1798.0438	1510.2402	1167.2189	774.8533	491.7472	518.5709	829.3218	1255.9897	1670.7014	2023.8121 (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	1053.1412	841.2120	724.7294	437.3553	210.3506	0.0000	0.0000	0.0000	0.0000	436.7877	767.1902	1073.9890 (98)
Space heating												5544.7555 (98)
Space heating per m2												(98) / (4) = 42.9959 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													6126.8016	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1053.1412	841.2120	724.7294	437.3553	210.3506	0.0000	0.0000	0.0000	0.0000	436.7877	767.1902	1073.9890	(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)	1163.6919	929.5161	800.8059	483.2656	232.4316	0.0000	0.0000	0.0000	0.0000	482.6384	847.7240	1186.7281	(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	90.0138	89.9741	89.8872	89.6786	89.1893	87.3000	87.3000	87.3000	87.3000	89.6549	89.9214	90.0338	(217)	
Fuel for water heating, kWh/month	202.1932	177.3550	184.2315	162.4625	157.8323	140.7841	132.0841	149.2571	150.3538	168.6593	181.6647	196.2521	(219)	
Water heating fuel used												2003.1297	(219)	
Annual totals kWh/year														
Space heating fuel - main system													6126.8016	(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													8701.4409	(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	6126.8016	0.2160	1323.3892 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.1297	0.2160	432.6760 (264)
Space and water heating			1756.0652 (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			2052.6786 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9200 (273)

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

DER		15.9200	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		31.0037	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		31.0037	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	18.1600	102.2900	0.1800	18.4122		(29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.1800	5.7402		(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

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2861	45.6666	47.1888	49.2861	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each 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 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	Solar input (sum of months) = Sum (63)m =				0.0000 (63)
	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)
	Total per year (kWh/year) = Sum (64)m =											2208.1083 (64)
Heat gains from water heating, kWh/month	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		
Southeast												8.1100	36.7938		0.6300		0.7000		0.7700		91.1943 (77)		
Southwest												0.6000	36.7938		0.6300		0.7000		0.7700		6.7468 (79)		
Northwest												10.0700	11.2829		0.6300		0.7000		0.7700		34.7235 (81)		
Solar gains		132.6646	237.5107	355.6082	491.9659	597.9128	614.2055	583.5800	501.3869	402.3325	270.7601	161.0020	112.1741 (83)										
Total gains		618.7589	721.1611	821.9075	930.1181	1006.4317	994.5157	946.3772	871.6360	787.9327	684.7424	607.5412	583.6023 (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	0.9993	0.9983	0.9949	0.9805	0.9274	0.7911	0.6223	0.6889	0.9120	0.9900	0.9985	0.9995	(86)
MIT	19.7021	19.8431	20.0854	20.4179	20.7255	20.9237	20.9830	20.9718	20.8196	20.4236	20.0041	19.6796	(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	0.9991	0.9977	0.9930	0.9723	0.8952	0.7065	0.4958	0.5630	0.8597	0.9845	0.9979	0.9993	(89)
MIT 2	18.2475	18.4551	18.8103	19.2977	19.7230	19.9633	20.0116	20.0072	19.8549	19.3116	18.6981	18.2204	(90)
Living area fraction	18.4253	18.6247	18.9662	19.4346	19.8455	20.0807	20.1303	20.1251	19.9728	19.4475	18.8577	18.3987	(91)
MIT	18.4253	18.6247	18.9662	19.4346	19.8455	20.0807	20.1303	20.1251	19.9728	19.4475	18.8577	18.3987	(92)
Temperature adjustment	18.4253	18.6247	18.9662	19.4346	19.8455	20.0807	20.1303	20.1251	19.9728	19.4475	18.8577	18.3987	(93)
adjusted MIT	18.4253	18.6247	18.9662	19.4346	19.8455	20.0807	20.1303	20.1251	19.9728	19.4475	18.8577	18.3987	(93)

8. Space heating requirement

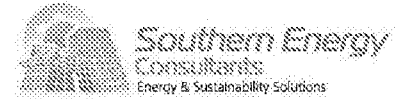
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9964	0.9901	0.9658	0.8886	0.7126	0.5110	0.5776	0.8569	0.9799	0.9967	0.9989	(94)
Useful gains	617.8172	718.5884	813.7336	898.2942	894.3365	708.6598	483.5702	503.4400	675.1754	670.9575	605.5266	582.9488	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2018.9407	1957.0802	1773.5163	1482.4423	1143.8855	762.2898	491.0217	517.1746	819.8666	1242.4760	1658.0283	2010.9358	(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	1042.4359	832.2665	714.0783	420.5866	185.6645	0.0000	0.0000	0.0000	0.0000	425.2098	757.8012	1062.4223	(98)
Space heating												5440.4651	(98)
Space heating per m2												42.1872	(99)
(98) / (4) =													

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												5824.9091 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1042.4359	832.2665	714.0783	420.5866	185.6645	0.0000	0.0000	0.0000	0.0000	425.2098	757.8012	1062.4223 (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)	1116.0984	891.0776	764.5378	450.3069	198.7842	0.0000	0.0000	0.0000	0.0000	455.2568	811.3503	1137.4971 (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	88.4696	88.3106	87.9564	87.0991	85.1858	80.3000	80.3000	80.3000	80.3000	87.0425	88.0954	88.5366 (217)
Fuel for water heating, kWh/month	247.3182	218.3469	230.1587	208.2449	206.6129	193.0452	184.9520	206.1782	207.9436	216.0837	225.8896	241.1493 (219)
Water heating fuel used												2585.9231 (219)
Annual totals kWh/year												
Space heating fuel - main system												5824.9091 (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												8982.3418 (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	5824.9091	0.2160	1258.1804 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2585.9231	0.2160	558.5594 (264)
Space and water heating			1816.7398 (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			2113.3532 (272)
Emissions per m2 for space and water heating			14.0876 (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) = (14.0876 * 1.00) + 1.9982 + 0.3018, rounded to 2 d.p.			16.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) = 92.2947 (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	152.3257	151.9901	151.6611	150.1158	149.8267	148.4808	148.4808	148.2315	148.9992	149.8267	150.4116	151.0230 (39)
Average = Sum(39)m / 12 =												150.1144 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1812	1.1786	1.1760	1.1640	1.1618	1.1514	1.1514	1.1494	1.1554	1.1618	1.1663	1.1711 (40)
HLP (average)												1.1640 (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
Southeast	8.1100	36.7938	0.4400	0.0000	0.7700	101.0972 (77)
Southwest	0.6000	36.7938	0.4400	0.0000	0.7700	7.4795 (79)
Northwest	10.0700	11.2829	0.4400	0.0000	0.7700	38.4942 (81)

Solar gains	147.0709	263.3023	394.2242	545.3892	662.8410	680.9031	646.9519	555.8333	446.0224	300.1623	178.4855	124.3553	(83)
Total gains	585.9705	700.6159	815.9679	941.4074	1031.3603	1024.1320	974.5494	887.7672	791.8887	671.9043	579.9542	549.4430	(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	42.5162	42.6101	42.7025	43.1421	43.2253	43.6172	43.6172	43.6905	43.4654	43.2253	43.0572	42.8829	
alpha	3.8344	3.8407	3.8468	3.8761	3.8817	3.9078	3.9078	3.9127	3.8977	3.8817	3.8705	3.8589	
util living area	0.9972	0.9941	0.9860	0.9607	0.8950	0.7654	0.6165	0.6807	0.8849	0.9779	0.9949	0.9979	(86)
MIT	19.1864	19.3788	19.7077	20.1525	20.5627	20.8449	20.9511	20.9277	20.6952	20.1622	19.5941	19.1548	(87)
Th 2	19.9351	19.9372	19.9392	19.9489	19.9507	19.9591	19.9591	19.9607	19.9559	19.9507	19.9470	19.9432	(88)
util rest of house	0.9965	0.9926	0.9821	0.9486	0.8603	0.6860	0.4928	0.5604	0.8325	0.9691	0.9933	0.9973	(89)
MIT 2	18.2712	18.4646	18.7931	19.2375	19.6263	19.8722	19.9419	19.9324	19.7573	19.2535	18.6874	18.2458	(90)
Living area fraction	FLA = Living area / (4) = 0.1222 (91)												
MIT	18.3830	18.5763	18.9048	19.3493	19.7407	19.9911	20.0652	20.0540	19.8719	19.3646	18.7982	18.3569	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.3830	18.5763	18.9048	19.3493	19.7407	19.9911	20.0652	20.0540	19.8719	19.3646	18.7982	18.3569	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	583.0255	693.4503	797.0555	884.6798	878.6172	705.3424	493.5943	508.1313	655.1152	646.5991	574.6321	547.2831	(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	2145.2101	2078.6613	1881.3311	1568.6033	1204.7141	800.4745	514.5195	541.6402	860.0067	1313.1680	1759.5470	2138.0171	(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	1162.2653	930.8618	806.7010	492.4249	242.6161	0.0000	0.0000	0.0000	0.0000	495.9273	853.1387	1183.5061	(98)
Space heating	6167.4413 (98)												
Space heating per m2	(98) / (4) = 47.8245 (99)												

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
	0.0000	0.0000	0.0000	0.0000	0.0000	1395.7193	1098.7577	1126.5597	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	0.7722	0.8456	0.8067	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1077.7730	929.1316	908.8516	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1316.0323	1255.4471	1156.4812	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	171.5467	242.7788	184.2364	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												598.5619 (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	42.8867	60.6947	46.0591	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												149.6405 (107)
Space cooling per m2												1.1604 (108)
Energy for space heating												47.8245 (99)
Energy for space cooling												1.1604 (108)
Total												48.9848 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.0 (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	18.1600	102.2900	0.1800	18.4122		(29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.1800	5.7402		(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												

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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	
Southeast	8.1100	36.7938	0.6300		0.7000	0.7700	91.1943	(77)
Southwest	0.6000	36.7938	0.6300		0.7000	0.7700	6.7468	(79)
Northwest	10.0700	11.2829	0.6300		0.7000	0.7700	34.7235	(81)

Solar gains	132.6646	237.5107	355.6082	491.9659	597.9128	614.2055	583.5800	501.3869	402.3325	270.7601	161.0020	112.1741	(83)
Total gains	571.5643	674.8242	777.3519	887.9841	966.4320	957.4344	911.1776	833.3208	748.1988	642.5021	562.4707	537.2618	(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	0.9988	0.9961	0.9840	0.9369	0.8089	0.6424	0.7126	0.9260	0.9924	0.9990	0.9997	(86)
MIT	19.6676	19.8093	20.0535	20.3898	20.7050	20.9147	20.9804	20.9669	20.8006	20.3940	19.9711	19.6456	(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	0.9994	0.9983	0.9946	0.9771	0.9078	0.7265	0.5137	0.5860	0.8791	0.9882	0.9985	0.9996	(89)
MIT 2	18.7671	18.9103	19.1556	19.4960	19.7965	19.9756	20.0130	20.0095	19.8912	19.5043	19.0802	18.7517	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.8772	19.0202	19.2653	19.6052	19.9076	20.0903	20.1312	20.1265	20.0023	19.6130	19.1891	18.8609	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8772	19.0202	19.2653	19.6052	19.9076	20.0903	20.1312	20.1265	20.0023	19.6130	19.1891	18.8609	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9991	0.9977	0.9930	0.9733	0.9041	0.7333	0.5294	0.6011	0.8783	0.9858	0.9980	0.9994	(94)
Ext temp.	571.0516	673.2758	771.9167	864.2905	873.7209	702.1121	482.3609	500.8713	657.1493	633.3790	561.3325	536.9166	(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	2083.5272	2013.4756	1816.0748	1506.4528	1152.6046	763.6279	491.1380	517.3724	823.9936	1265.7155	1704.7658	2076.4035	(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	1125.2819	900.6143	776.8536	462.3568	207.4895	0.0000	0.0000	0.0000	0.0000	470.4583	823.2720	1145.3783	(98)
Space heating												5911.7048	(98)
Space heating per m ²										(98) / (4) =		45.8414	(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	0.8173	0.8930	0.8557	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1068.5533	919.0684	902.8560	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1238.0742	1181.3761	1092.8426	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													

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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	122.0551	195.1569	141.3500	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												458.5620 (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	30.5138	48.7892	35.3375	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												114.6405 (107)
Space cooling per m2												0.8890 (108)
Energy for space heating												45.8414 (99)
Energy for space cooling												0.8890 (108)
Total												46.7303 (109)
Target Fabric Energy Efficiency (TFEE)												53.7 (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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) =	92.2947 (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	149.5442	148.9992	148.9992	148.2315	148.2315	147.3010	147.5237	147.0850	147.3010	147.7530	147.7530	148.4808 (39)
Average = Sum(39)m / 12 =												148.1003 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1596	1.1554	1.1554	1.1494	1.1494	1.1422	1.1439	1.1405	1.1422	1.1457	1.1457	1.1514 (40)
HLP (average)												1.1484 (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

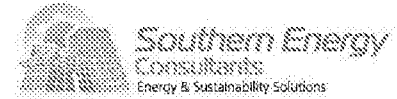
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF 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 (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)
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)
RHI water heating demand	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 (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				
Southeast			8.1100	40.4699	0.4400	0.0000	0.7700	111.1979 (77)				
Southwest			0.6000	40.4699	0.4400	0.0000	0.7700	8.2267 (79)				
Northwest			10.0700	12.9236	0.4400	0.0000	0.7700	44.0915 (81)				
Solar gains	163.5161	264.1850	392.7499	563.0007	668.5686	735.5521	691.1166	606.0271	482.7751	322.1433	203.4525	136.8346 (83)
Total gains	872.1425	967.1633	1067.5550	1194.1176	1254.5194	1281.6554	1214.4276	1139.3002	1041.6577	924.9495	854.9135	825.5199 (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	44.3849	44.5473	44.5473	44.7780	44.7780	45.0608	44.9928	45.1270	45.0608	44.9230	44.9230	44.7028
alpha	3.9590	3.9698	3.9698	3.9852	3.9852	4.0041	3.9995	4.0085	4.0041	3.9949	3.9949	3.9802
util living area	0.9880	0.9810	0.9612	0.9042	0.7763	0.5463	0.3718	0.4060	0.7142	0.9242	0.9777	0.9900 (86)
MIT	19.6149	19.7693	20.0853	20.4820	20.8059	20.9667	20.9947	20.9926	20.8987	20.5106	20.0057	19.5871 (87)
Th 2	19.9524	19.9559	19.9559	19.9607	19.9607	19.9665	19.9651	19.9679	19.9665	19.9637	19.9637	19.9591 (88)
util rest of house	0.9849	0.9761	0.9507	0.8773	0.7148	0.4450	0.2501	0.2786	0.6215	0.8966	0.9709	0.9874 (89)
MIT 2	18.1297	18.3553	18.8094	19.3655	19.7796	19.9477	19.9639	19.9660	19.8929	19.4181	18.7050	18.0941 (90)
Living area fraction	fLA = Living area / (4) = 0.1222 (91)											
MIT	18.3112	18.5281	18.9654	19.5020	19.9050	20.0723	20.0899	20.0914	20.0158	19.5516	18.8639	18.2765 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.1612	18.3781	18.8154	19.3520	19.7550	19.9223	19.9399	19.9414	19.8658	19.4016	18.7139	18.1265 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9768	0.9654	0.9350	0.8578	0.7010	0.4404	0.2471	0.2753	0.6113	0.8770	0.9589	0.9804 (94)
Useful gains	851.9388	933.6657	998.1346	1024.2620	879.3812	564.4459	300.0730	313.6547	636.7362	811.2256	819.7380	809.3177 (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	1953.2308	1903.9277	1700.8780	1401.0800	1001.3029	577.7535	300.9278	314.9737	687.2825	1152.7095	1583.0172	1934.1883 (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	819.3613	652.0161	522.8411	271.3090	90.7098	0.0000	0.0000	0.0000	0.0000	254.0640	549.5610	836.9037 (98)
Space heating	3996.7660 (98)											
RHI space heating demand	3997 (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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) =	92.2947 (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	152.3257	151.9901	151.6611	150.1158	149.8267	148.4808	148.4808	148.2315	148.9992	149.8267	150.4116	151.0230 (39)
Average = Sum(39)m / 12 =												150.1144 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1812	1.1786	1.1760	1.1640	1.1618	1.1514	1.1514	1.1494	1.1554	1.1618	1.1663	1.1711 (40)
HLP (average)												1.1640 (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 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
Southeast													8.1100	36.7938	0.4400	0.0000	0.7700		101.0972 (77)
Southwest													0.6000	36.7938	0.4400	0.0000	0.7700		7.4795 (79)
Northwest													10.0700	11.2829	0.4400	0.0000	0.7700		38.4942 (81)
Solar gains	147.0709	263.3023	394.2242	545.3892	662.8410	680.9031	646.9519	555.8333	446.0224	300.1623	178.4855	124.3553	(83)						
Total gains	855.6972	966.2806	1069.0293	1176.5062	1248.7918	1227.0064	1170.2628	1089.1064	1004.9050	902.9685	829.9465	813.0406	(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	43.5744	43.6707	43.7654	44.2159	44.3012	44.7028	44.7028	44.7780	44.5473	44.3012	44.1290	43.9503	
alpha	3.9050	3.9114	3.9177	3.9477	3.9534	3.9802	3.9802	3.9852	3.9698	3.9534	3.9419	3.9300	
util living area	0.9905	0.9839	0.9686	0.9282	0.8393	0.6867	0.5326	0.5860	0.8078	0.9479	0.9840	0.9922	(86)
MIT	19.4579	19.6388	19.9409	20.3389	20.6847	20.9015	20.9725	20.9600	20.8022	20.3587	19.8378	19.4232	(87)
Th 2	19.9351	19.9372	19.9392	19.9489	19.9507	19.9591	19.9591	19.9607	19.9559	19.9507	19.9470	19.9432	(88)
util rest of house	0.9882	0.9798	0.9604	0.9083	0.7940	0.6025	0.4179	0.4703	0.7388	0.9294	0.9793	0.9903	(89)
MIT 2	17.8898	18.1535	18.5908	19.1602	19.6236	19.8835	19.9460	19.9398	19.7817	19.1993	18.4512	17.8446	(90)
Living area fraction	18.0814	18.3350	18.7558	19.3043	19.7533	20.0079	20.0715	20.0644	19.9064	19.3410	18.6207	18.0375	(91)
MIT	18.0814	18.3350	18.7558	19.3043	19.7533	20.0079	20.0715	20.0644	19.9064	19.3410	18.6207	18.0375	(92)
Temperature adjustment	17.9314	18.1850	18.6058	19.1543	19.6033	19.8579	19.9215	19.9144	19.7564	19.1910	18.4707	17.8875	(93)
adjusted MIT	17.9314	18.1850	18.6058	19.1543	19.6033	19.8579	19.9215	19.9144	19.7564	19.1910	18.4707	17.8875	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	839.7058	937.2953	1011.3239	1046.0320	969.5162	728.2146	483.8959	506.1946	726.7721	822.7505	804.5274	800.3114	(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	2076.4124	2019.1960	1835.9743	1539.3285	1184.1191	780.6923	493.1768	520.9508	842.7945	1287.1621	1710.2796	2067.1268	(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	920.1097	727.0373	613.5399	355.1735	159.6645	0.0000	0.0000	0.0000	0.0000	345.5222	652.1415	942.5106	(98)
Space heating													4715.6993 (98)
Space heating per m2													(98) / (4) = 36.5671 (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													5210.7175 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.1097	727.0373	613.5399	355.1735	159.6645	0.0000	0.0000	0.0000	0.0000	345.5222	652.1415	942.5106	(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)	1016.6958	803.3561	677.9446	392.4569	176.4249	0.0000	0.0000	0.0000	0.0000	381.7925	720.5984	1041.4482	(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	89.9555	89.9069	89.8004	89.5452	88.9719	87.3000	87.3000	87.3000	87.3000	89.5013	89.8403	89.9793	(217)
Fuel for water heating, kWh/month	202.3243	177.4878	184.4096	162.7044	158.2179	140.7841	132.0841	149.2571	150.3538	168.9487	181.8286	196.3709	(219)
Water heating fuel used												2004.7712	(219)
Annual totals kWh/year													
Space heating fuel - main system												5210.7175	(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												7786.9982	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5210.7175	3.4800	181.3330 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.7712	3.4800	69.7660 (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			446.4811 (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] = 1.0780 (257)
SAP value	84.9624
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	5210.7175	0.2160	1125.5150 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.7712	0.2160	433.0306 (264)
Space and water heating			1558.5455 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1855.1590 (272)
CO2 emissions per m2			14.3900 (273)
EI value			85.7099
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	$3.48 / 0.8889 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8889 = 0.2430$, 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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) =	92.2947 (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	149.5442	148.9992	148.9992	148.2315	148.2315	147.3010	147.5237	147.0850	147.3010	147.7530	147.7530	148.4808 (39)
Average = Sum(39)m / 12 =												148.1003 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1596	1.1554	1.1554	1.1494	1.1494	1.1422	1.1439	1.1405	1.1422	1.1457	1.1457	1.1514 (40)
HLP (average)												1.1484 (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 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)

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
Southeast				8.1100	40.4699		0.4400		0.0000		0.7700		111.1979 (77)
Southwest				0.6000	40.4699		0.4400		0.0000		0.7700		8.2267 (79)
Northwest				10.0700	12.9236		0.4400		0.0000		0.7700		44.0915 (81)
Solar gains	163.5161	264.1850	392.7499	563.0007	668.5686	735.5521	691.1166	606.0271	482.7751	322.1433	203.4525	136.8346	(83)
Total gains	872.1425	967.1633	1067.5550	1194.1176	1254.5194	1281.6554	1214.4276	1139.3002	1041.6577	924.9495	854.9135	825.5199	(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	44.3849	44.5473	44.5473	44.7780	44.7780	45.0608	44.9928	45.1270	45.0608	44.9230	44.9230	44.7028
alpha	3.9590	3.9698	3.9698	3.9852	3.9852	4.0041	3.9995	4.0085	4.0041	3.9949	3.9949	3.9802
util living area	0.9880	0.9810	0.9612	0.9042	0.7763	0.5463	0.3718	0.4060	0.7142	0.9242	0.9777	0.9900 (86)
MIT	19.6149	19.7693	20.0853	20.4820	20.8059	20.9667	20.9947	20.9926	20.8987	20.5106	20.0057	19.5871 (87)
Th 2	19.9524	19.9559	19.9559	19.9607	19.9607	19.9665	19.9651	19.9679	19.9665	19.9637	19.9637	19.9591 (88)
util rest of house	0.9849	0.9761	0.9507	0.8773	0.7148	0.4450	0.2501	0.2786	0.6215	0.8966	0.9709	0.9874 (89)
MIT 2	18.1297	18.3553	18.8094	19.3655	19.7796	19.9477	19.9639	19.9660	19.8929	19.4181	18.7050	18.0941 (90)
Living area fraction	18.3112	18.5281	18.9654	19.5020	19.9050	20.0723	20.0899	20.0914	20.0158	19.5516	18.8639	18.2765 (92)
MIT	18.1612	18.3781	18.8154	19.3520	19.7550	19.9223	19.9399	19.9414	19.8658	19.4016	18.7139	18.1265 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.1265 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9768	0.9654	0.9350	0.8578	0.7010	0.4404	0.2471	0.2753	0.6113	0.8770	0.9589	0.9804	(94)	
Useful gains	851.9388	933.6657	998.1346	1024.2620	879.3812	564.4459	300.0730	313.6547	636.7362	811.2256	819.7380	809.3177	(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	1953.2308	1903.9277	1700.8780	1401.0800	1001.3029	577.7535	300.9278	314.9737	687.2825	1152.7095	1583.0172	1934.1883	(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	819.3613	652.0161	522.8411	271.3090	90.7098	0.0000	0.0000	0.0000	0.0000	254.0640	549.5610	836.9037	(98)	
Space heating												3996.7660	(98)	
Space heating per m2												(98) / (4) =	30.9923	(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													4416.3160	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	819.3613	652.0161	522.8411	271.3090	90.7098	0.0000	0.0000	0.0000	0.0000	254.0640	549.5610	836.9037	(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)	905.3716	720.4597	577.7250	299.7889	100.2318	0.0000	0.0000	0.0000	0.0000	280.7337	607.2498	924.7555	(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	89.9011	89.8524	89.7090	89.3556	88.5266	87.3000	87.3000	87.3000	87.3000	89.2790	89.7462	89.9254	(216)	
Fuel for water heating, kWh/month	202.4468	177.5953	184.5974	163.0496	159.0137	140.7841	132.0841	149.2571	150.3538	169.3694	182.0193	196.4886	(219)	
Water heating fuel used												2007.0592	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4416.3160	(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													6994.8848	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4416.3160	3.8700	170.9114 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2007.0592	3.8700	77.6732 (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			449.5999 (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	4416.3160	0.2160	953.9243 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.0592	0.2160	433.5248 (264)
Space and water heating			1387.4490 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1684.0625 (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	4416.3160	1.2200	5387.9055 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2007.0592	1.2200	2448.6122 (264)
Space and water heating			7836.5177 (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			9591.0521 (272)
Primary energy kWh/m2/year			74.3723 (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 (56.2%)

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	£342	£342	£0
Space heating	£278	£278	£0
Water heating	£78	£78	£0
Lighting	£94	£94	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£450	£105	£345
Total cost of uses	£450	£105	£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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) =	92.2947 (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	152.3257	151.9901	151.6611	150.1158	149.8267	148.4808	148.4808	148.2315	148.9992	149.8267	150.4116	151.0230 (39)
Average = Sum(39)m / 12 =												150.1144 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1812	1.1786	1.1760	1.1640	1.1618	1.1514	1.1514	1.1494	1.1554	1.1618	1.1663	1.1711 (40)
HLP (average)												1.1640 (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

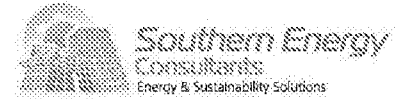
Elmhurst Energy Systems

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		
Southeast				8.1100	36.7938	0.4400	0.0000	0.7700		101.0972 (77)		
Southwest				0.6000	36.7938	0.4400	0.0000	0.7700		7.4795 (79)		
Northwest				10.0700	11.2829	0.4400	0.0000	0.7700		38.4942 (81)		
Solar gains	147.0709	263.3023	394.2242	545.3892	662.8410	680.9031	646.9519	555.8333	446.0224	300.1623	178.4855	124.3553 (83)
Total gains	855.6972	966.2806	1069.0293	1176.5062	1248.7918	1227.0064	1170.2628	1089.1064	1004.9050	902.9685	829.9465	813.0406 (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	43.5744	43.6707	43.7654	44.2159	44.3012	44.7028	44.7028	44.7780	44.5473	44.3012	44.1290	43.9503
alpha	3.9050	3.9114	3.9177	3.9477	3.9534	3.9802	3.9802	3.9852	3.9698	3.9534	3.9419	3.9300
util living area	0.9905	0.9839	0.9686	0.9282	0.8393	0.6867	0.5326	0.5860	0.8078	0.9479	0.9840	0.9922 (86)
MIT	19.4579	19.6388	19.9409	20.3389	20.6847	20.9015	20.9725	20.9600	20.8022	20.3587	19.8378	19.4232 (87)
Th 2	19.9351	19.9372	19.9392	19.9489	19.9507	19.9591	19.9591	19.9607	19.9559	19.9507	19.9470	19.9432 (88)
util rest of house	0.9882	0.9798	0.9604	0.9083	0.7940	0.6025	0.4179	0.4703	0.7388	0.9294	0.9793	0.9903 (89)
MIT 2	17.8898	18.1535	18.5908	19.1602	19.6236	19.8835	19.9460	19.9398	19.7817	19.1993	18.4512	17.8446 (90)
Living area fraction	18.0814	18.3350	18.7558	19.3043	19.7533	20.0079	20.0715	20.0644	19.9064	19.3410	18.6207	18.0375 (91)
MIT	18.0814	18.3350	18.7558	19.3043	19.7533	20.0079	20.0715	20.0644	19.9064	19.3410	18.6207	18.0375 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9314	18.1850	18.6058	19.1543	19.6033	19.8579	19.9215	19.9144	19.7564	19.1910	18.4707	17.8875 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	839.7058	937.2953	1011.3239	1046.0320	969.5162	728.2146	483.8959	506.1946	726.7721	822.7505	804.5274	800.3114	(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	2076.4124	2019.1960	1835.9743	1539.3285	1184.1191	780.6923	493.1768	520.9508	842.7945	1287.1621	1710.2796	2067.1268	(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	920.1097	727.0373	613.5399	355.1735	159.6645	0.0000	0.0000	0.0000	0.0000	345.5222	652.1415	942.5106	(98)
Space heating												4715.6993	(98)
Space heating per m2												36.5671	(99)

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

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													5210.7175 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.1097	727.0373	613.5399	355.1735	159.6645	0.0000	0.0000	0.0000	0.0000	345.5222	652.1415	942.5106	(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)	1016.6958	803.3561	677.9446	392.4569	176.4249	0.0000	0.0000	0.0000	0.0000	381.7925	720.5984	1041.4482	(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	89.9555	89.9069	89.8004	89.5452	88.9719	87.3000	87.3000	87.3000	87.3000	89.5013	89.8403	89.9793	(217)
Fuel for water heating, kWh/month	202.3243	177.4878	184.4096	162.7044	158.2179	140.7841	132.0841	149.2571	150.3538	168.9487	181.8286	196.3709	(219)
Water heating fuel used												2004.7712	(219)
Annual totals kWh/year													
Space heating fuel - main system													5210.7175 (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													6059.7588 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5210.7175	3.4800	181.3330 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.7712	3.4800	69.7660 (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			218.6582 (255)

11a. SAP rating - Individual heating systems

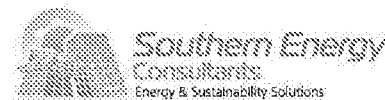
Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5279 (257)
SAP value		92.6356
SAP rating (Section 12)		93 (258)
SAP band		A

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	5210.7175	0.2160	1125.5150 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.7712	0.2160	433.0306 (264)
Space and water heating			1558.5455 (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			958.7218 (272)
CO2 emissions per m2			7.4300 (273)
EI value			92.6150
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	18.1600	102.2900	0.2500	25.5725	60.0000	6137.4000 (29a)
Tile Hung Cavity	36.8100	4.9200	31.8900	0.2400	7.6536	60.0000	1913.4000 (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) =	82.2273		(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) =	92.2947 (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	149.5442	148.9992	148.9992	148.2315	148.2315	147.3010	147.5237	147.0850	147.3010	147.7530	147.7530	148.4808 (39)
Average = Sum(39)m / 12 =												148.1003 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1596	1.1554	1.1554	1.1494	1.1494	1.1422	1.1439	1.1405	1.1422	1.1457	1.1457	1.1514 (40)
HLP (average)												1.1484 (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 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
Southeast				8.1100	40.4699		0.4400		0.0000		0.7700		111.1979 (77)
Southwest				0.6000	40.4699		0.4400		0.0000		0.7700		8.2267 (79)
Northwest				10.0700	12.9236		0.4400		0.0000		0.7700		44.0915 (81)
Solar gains	163.5161	264.1850	392.7499	563.0007	668.5686	735.5521	691.1166	606.0271	482.7751	322.1433	203.4525	136.8346	(83)
Total gains	872.1425	967.1633	1067.5550	1194.1176	1254.5194	1281.6554	1214.4276	1139.3002	1041.6577	924.9495	854.9135	825.5199	(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	44.3849	44.5473	44.5473	44.7780	44.7780	45.0608	44.9928	45.1270	45.0608	44.9230	44.9230	44.7028
alpha	3.9590	3.9698	3.9698	3.9852	3.9852	4.0041	3.9995	4.0085	4.0041	3.9949	3.9949	3.9802
util living area	0.9880	0.9810	0.9612	0.9042	0.7763	0.5463	0.3718	0.4060	0.7142	0.9242	0.9777	0.9900 (86)
MIT	19.6149	19.7693	20.0853	20.4820	20.8059	20.9667	20.9947	20.9926	20.8987	20.5106	20.0057	19.5871 (87)
Th 2	19.9524	19.9559	19.9559	19.9607	19.9607	19.9665	19.9651	19.9679	19.9665	19.9637	19.9637	19.9591 (88)
util rest of house	0.9849	0.9761	0.9507	0.8773	0.7148	0.4450	0.2501	0.2786	0.6215	0.8966	0.9709	0.9874 (89)
MIT 2	18.1297	18.3553	18.8094	19.3655	19.7796	19.9477	19.9639	19.9660	19.8929	19.4181	18.7050	18.0941 (90)
Living area fraction	18.3112	18.5281	18.9654	19.5020	19.9050	20.0723	20.0899	20.0914	20.0158	19.5516	18.8639	18.2765 (91)
MIT	18.1612	18.3781	18.8154	19.3520	19.7550	19.9223	19.9399	19.9414	19.8658	19.4016	18.7139	18.1265 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1612	18.3781	18.8154	19.3520	19.7550	19.9223	19.9399	19.9414	19.8658	19.4016	18.7139	18.1265 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9768	0.9654	0.9350	0.8578	0.7010	0.4404	0.2471	0.2753	0.6113	0.8770	0.9589	0.9804	0.9804	(94)
Useful gains	851.9388	933.6657	998.1346	1024.2620	879.3812	564.4459	300.0730	313.6547	636.7362	811.2256	819.7380	809.3177	(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	1953.2308	1903.9277	1700.8780	1401.0800	1001.3029	577.7535	300.9278	314.9737	687.2825	1152.7095	1583.0172	1934.1883	(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	819.3613	652.0161	522.8411	271.3090	90.7098	0.0000	0.0000	0.0000	0.0000	254.0640	549.5610	836.9037	(98)
Space heating												3996.7660	(98)
Space heating per m2												(98) / (4) =	30.9923 (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													4416.3160 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	819.3613	652.0161	522.8411	271.3090	90.7098	0.0000	0.0000	0.0000	0.0000	254.0640	549.5610	836.9037	(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)	905.3716	720.4597	577.7250	299.7889	100.2318	0.0000	0.0000	0.0000	0.0000	280.7337	607.2498	924.7555	(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	89.9011	89.8524	89.7090	89.3556	88.5266	87.3000	87.3000	87.3000	87.3000	89.2790	89.7462	89.9254	(216)
Fuel for water heating, kWh/month	202.4468	177.5953	184.5974	163.0496	159.0137	140.7841	132.0841	149.2571	150.3538	169.3694	182.0193	196.4886	(219)
Water heating fuel used												2007.0592	(219)
Annual totals kWh/year													
Space heating fuel - main system												4416.3160	(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												5170.7251	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4416.3160	3.8700	170.9114	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2007.0592	3.8700	77.6732	(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			104.8338	(255)

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

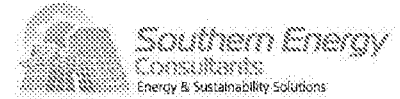
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4416.3160	0.2160	953.9243	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2007.0592	0.2160	433.5248	(264)
Space and water heating			1387.4490	(265)
Pumps and fans	75.0000	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			737.3237	(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	4416.3160	1.2200	5387.9055	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2007.0592	1.2200	2448.6122	(264)
Space and water heating			7836.5177	(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			3990.8820	(272)
Primary energy kWh/m2/year			30.9467	(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 East
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	92.29 (37)
Summer heat loss coefficient	503.39 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	8.1100	119.9223	0.4400	0.0000	0.9000	385.1378
South West	0.6000	119.9223	0.4400	0.0000	0.9000	28.4935
North West	10.0700	98.8453	0.4400	0.0000	0.9000	394.1673
total:						807.7986

	Jun	Jul	Aug	
Solar gains	860	808	708	(P4)
Internal gains	543	520	530	
Total summer gains	1403	1328	1239	(P5)
Summer gain/loss ratio	2.79	2.64	2.46	(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	19.49	21.24	20.96	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			