

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG005d		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Re Ea Ga		
Property	Lockwood Corner, Plot 3				
SAP Rating	83 B	DER	18.80	TET	19.15
Environmental	85 B	% DER<TER	1.84		
CO ₂ Emissions (t/year)	1.42	DPEE	55.31	TPEE	59.69
General Requirements Compliance	Pass	% DPEE<TPEE	7.34		
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 92 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.15 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.80 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)55.3 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

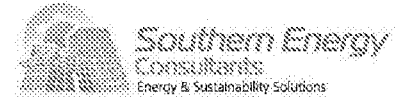
Overshading: Average
Windows facing North: 6.97 m², No overhang
Windows facing East: 5.16 m², No overhang
Windows facing South: 0.48 m², No overhang
Windows facing West: 3.93 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

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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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =	0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (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	44.5528	44.2437	43.9407	42.5176	42.2513	41.0119	41.0119	40.7823	41.4893	42.2513	42.7900	43.3531 (38)
Heat transfer coeff	123.9763	123.6672	123.3642	121.9411	121.6749	120.4354	120.4354	120.2059	120.9128	121.6749	122.2135	122.7766 (39)
Average = Sum(39)m / 12 =												121.9399 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3532	1.3498	1.3465	1.3309	1.3280	1.3145	1.3145	1.3120	1.3197	1.3280	1.3339	1.3401 (40)
HLP (average)												1.3309 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (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											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (65)
Total per year (kWh/year) = Sum(64)m =	1692.8195 (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	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	405.2814	403.0836	388.4352	364.7507	340.5809	317.3937	302.4005	308.6676	320.8965	344.8027	372.2646	392.9778	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.9700	10.6334	0.4400	0.0000	0.7700	25.1101 (74)			
East				5.1600	19.6403	0.4400	0.0000	0.7700	34.3353 (76)			
South				0.4800	46.7521	0.4400	0.0000	0.7700	7.6030 (78)			
West				3.9300	19.6403	0.4400	0.0000	0.7700	26.1507 (80)			
Solar gains	93.1990	178.7618	292.2641	433.0968	543.4079	563.3956	533.3476	448.5373	341.2401	210.9529	115.4076	77.2434 (83)
Total gains	498.4805	581.8454	680.6993	797.8475	883.9888	880.7893	835.7481	757.2048	662.1366	555.7555	487.6722	470.2212 (84)

7. Mean internal temperature (heating season)

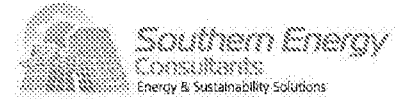
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6597	39.7589	39.8565	40.3216	40.4099	40.8258	40.8258	40.9037	40.6646	40.4099	40.2318	40.0473
alpha	3.6440	3.6506	3.6571	3.6881	3.6940	3.7217	3.7217	3.7269	3.7110	3.6940	3.6821	3.6698
util living area	0.9958	0.9920	0.9817	0.9496	0.8719	0.7328	0.5859	0.6514	0.8681	0.9726	0.9928	0.9966 (86)
MIT	19.1181	19.3085	19.6584	20.1377	20.5663	20.8489	20.9515	20.9280	20.6875	20.1287	19.5419	19.0889 (87)
Th 2	19.7994	19.8020	19.8046	19.8167	19.8189	19.8295	19.8295	19.8314	19.8254	19.8189	19.8144	19.8096 (88)
util rest of house	0.9946	0.9898	0.9762	0.9333	0.8283	0.6415	0.4505	0.5174	0.8049	0.9609	0.9903	0.9956 (89)
MIT 2	17.3028	17.5818	18.0917	18.7847	19.3689	19.7151	19.8076	19.7949	19.5444	18.7843	17.9314	17.2664 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	17.6503	17.9124	18.3916	19.0437	19.5982	19.9321	20.0266	20.0118	19.7633	19.0417	18.2397	17.6153 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5003	17.7624	18.2416	18.8937	19.4482	19.7821	19.8766	19.8618	19.6133	18.8917	18.0897	17.4653 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9908	0.9837	0.9655	0.9161	0.8115	0.6373	0.4565	0.5213	0.7904	0.9471	0.9846	0.9925	(94)	
Useful gains	493.9061	572.3691	657.2038	730.8917	717.3789	561.2993	381.4784	394.7328	523.3408	526.3823	480.1568	466.7081	(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	1636.5237	1590.6555	1448.4962	1218.6445	942.7560	624.1109	394.6155	416.1296	666.6245	1008.8868	1343.0932	1628.6680	(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	850.1075	684.2884	588.7215	351.1821	167.6805	0.0000	0.0000	0.0000	0.0000	358.9833	621.3142	864.4982	(98)	
Space heating												4486.7758	(98)	
Space heating per m2												(98) / (4) =	48.9716	(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													4957.7633 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	850.1075	684.2884	588.7215	351.1821	167.6805	0.0000	0.0000	0.0000	0.0000	358.9833	621.3142	864.4982	(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)	939.3453	756.1198	650.5210	388.0465	185.2824	0.0000	0.0000	0.0000	0.0000	396.6667	686.5350	955.2466	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789	(64)
Efficiency of water heater (217)m	89.9439	89.9035	89.8069	89.5728	89.0527	87.3000	87.3000	87.3000	87.3000	89.5628	89.8429	87.3000	(216)
Fuel for water heating, kWh/month	191.7723	168.2386	174.8309	154.2803	149.9912	133.6702	125.4920	141.6911	142.6987	160.1504	172.3791	186.1605	(219)
Water heating fuel used												1901.3550	(219)
Annual totals kWh/year													
Space heating fuel - main system												4957.7633	(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)												389.0105	(232)
Total delivered energy for all uses												7323.1288	(238)

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

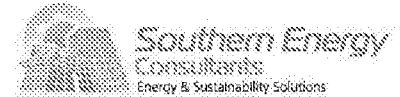
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4957.7633	0.2160	1070.8769	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1901.3550	0.2160	410.6927	(264)
Space and water heating			1481.5696	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.0105	0.5190	201.8964	(268)
Total CO2, kg/year			1722.3910	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.8000	(273)

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

DER		18.8000	ZC1
Total Floor Area	TFA	91.6200	
Assumed number of occupants	N	2.6473	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.6538	ZC2
CO2 emissions from cooking, equation (L16)		1.9923	ZC3
Total CO2 emissions		36.4461	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.4461	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1353 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3853 (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) =	0.3275 (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	0.4175	0.4094	0.4012	0.3602	0.3520	0.3111	0.3111	0.3029	0.3275	0.3520	0.3684	0.3848 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5740 (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)			16.5400	1.3258	21.9280		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.1800	20.5920		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Bay Roof/GRP	0.5300		0.5300	0.1300	0.0689		(30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.1671		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5960 (36)
Total fabric heat loss						(33) + (36) =	70.7631 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.9721	42.7244	42.4816	41.3411	41.1277	40.1343	40.1343	39.9504	40.5169	41.1277	41.5593	42.0106 (38)
Heat transfer coeff	113.7352	113.4875	113.2447	112.1042	111.8908	110.8974	110.8974	110.7135	111.2801	111.8908	112.3225	112.7738 (39)
Average = Sum(39)m / 12 =												112.1032 (39)
HLP	1.2414	1.2387	1.2360	1.2236	1.2212	1.2104	1.2104	1.2084	1.2146	1.2212	1.2260	1.2309 (40)
HLP (average)												1.2236 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)
Energy content (annual)										Total = Sum(45)m =		1527.3239 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	50.4563	46.9138	46.4989	43.0841	44.5202	46.4989	46.9138	50.4563	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.3097	184.5220	193.3703	171.5097	166.0517	146.2491	140.1177	156.1984	157.9235	179.8274	190.5337	204.3132 (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	209.3097	184.5220	193.3703	171.5097	166.0517	146.2491	140.1177	156.1984	157.9235	179.8274	190.5337	204.3132 (64)
Heat gains from water heating, kWh/month	65.3914	57.5563	60.1330	53.1566	51.3760	45.0734	42.9162	48.0998	48.6392	55.6300	59.2840	63.7300 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 2099.9266 (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)
(66)m	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	87.8916	85.6493	80.8239	73.8286	69.0538	62.6019	57.6831	64.6503	67.5544	74.7714	82.3388	85.6586	(72)
Total internal gains	417.6545	415.4608	400.6530	376.3190	351.4951	327.6559	312.6704	319.5890	332.4755	357.0313	384.6477	405.3549	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.9700	10.6334	0.6300	0.7000	0.7700		22.6504 (74)	
East					5.1600	19.6403	0.6300	0.7000	0.7700		30.9720 (76)	
South					0.4800	46.7521	0.6300	0.7000	0.7700		6.8583 (78)	
West					3.9300	19.6403	0.6300	0.7000	0.7700		23.5891 (80)	
Solar gains	84.0698	161.2513	263.6355	390.6730	490.1786	508.2085	481.1037	404.6010	307.8140	190.2891	104.1029	69.6771 (83)
Total gains	501.7243	576.7120	664.2885	766.9920	841.6737	835.8643	793.7741	724.1900	640.2896	547.3203	488.7506	475.0319 (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	55.9413	56.0634	56.1836	56.7552	56.8635	57.3728	57.3728	57.4682	57.1756	56.8635	56.6449	56.4183	
alpha	4.7294	4.7376	4.7456	4.7837	4.7909	4.8249	4.8249	4.8312	4.8117	4.7909	4.7763	4.7612	
util living area	0.9986	0.9971	0.9918	0.9705	0.9022	0.7544	0.5907	0.6595	0.8937	0.9855	0.9973	0.9990	(86)
MIT	19.5901	19.7369	20.0077	20.3809	20.7154	20.9197	20.9806	20.9679	20.8018	20.3683	19.9143	19.5655	(87)
Th 2	19.8870	19.8892	19.8913	19.9012	19.9030	19.9117	19.9117	19.9133	19.9084	19.9030	19.8993	19.8954	(88)
util rest of house	0.9982	0.9961	0.9887	0.9583	0.8611	0.6605	0.4566	0.5244	0.8318	0.9777	0.9962	0.9986	(89)
MIT 2	18.0086	18.2246	18.6205	19.1631	19.6169	19.8568	19.9045	19.8996	19.7396	19.1533	18.4913	17.9784	(90)
Living area fraction	18.3114	18.5141	18.8861	19.3962	19.8272	20.0603	20.1105	20.1042	19.9429	19.3859	18.7637	18.2822	(91)
MIT	18.3114	18.5141	18.8861	19.3962	19.8272	20.0603	20.1105	20.1042	19.9429	19.3859	18.7637	18.2822	(92)
Temperature adjustment	18.3114	18.5141	18.8861	19.3962	19.8272	20.0603	20.1105	20.1042	19.9429	19.3859	18.7637	18.2822	(93)
adjusted MIT	18.3114	18.5141	18.8861	19.3962	19.8272	20.0603	20.1105	20.1042	19.9429	19.3859	18.7637	18.2822	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9941	0.9846	0.9509	0.8577	0.6747	0.4823	0.5500	0.8342	0.9723	0.9943	0.9978	(94)
Useful gains	500.2685	573.3080	654.0731	729.3527	721.8843	563.9440	382.8274	398.2689	534.1483	532.1414	485.9807	473.9674	(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	1593.5859	1545.0309	1402.6566	1176.6671	909.3561	605.5322	389.3070	410.0999	650.2004	983.0651	1310.1008	1588.1050	(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	813.4281	652.9978	556.9461	322.0664	139.4790	0.0000	0.0000	0.0000	0.0000	335.4872	593.3665	828.9183	(98)
Space heating												4242.6895	(98)
Space heating per m2												46.3075	(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													4542.4941 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	813.4281	652.9978	556.9461	322.0664	139.4790	0.0000	0.0000	0.0000	0.0000	335.4872	593.3665	828.9183	(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)	870.9080	699.1411	596.3021	344.8248	149.3351	0.0000	0.0000	0.0000	0.0000	359.1940	635.2960	887.4929	(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	209.3097	184.5220	193.3703	171.5097	166.0517	146.2491	140.1177	156.1984	157.9235	179.8274	190.5337	204.3132	(64)
Efficiency of water heater (217)m	88.1314	87.9624	87.5617	86.6144	84.6158	80.3000	80.3000	80.3000	80.3000	86.5990	87.7183	88.2062	(216)
Fuel for water heating, kWh/month	237.4974	209.7737	220.8391	198.0152	196.2420	182.1283	174.4928	194.5186	196.6669	207.6553	217.2109	231.6314	(219)
Water heating fuel used												2466.6716	(219)
Annual totals kWh/year													
Space heating fuel - main system												4542.4941	(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)												389.0105	(232)
Total delivered energy for all uses												7473.1762	(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	4542.4941	0.2160	981.1787 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2466.6716	0.2160	532.8011 (264)
Space and water heating			1513.9798 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total CO2, kg/m2/year			1754.8012 (272)
Emissions per m2 for space and water heating			16.5246 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2036 (272b)
Emissions per m2 for pumps and fans			0.4249 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5246 * 1.00) + 2.2036 + 0.4249, rounded to 2 d.p.			19.1500 (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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1353 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3853 (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) =	0.3275 (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	0.4175	0.4094	0.4012	0.3602	0.3520	0.3111	0.3111	0.3029	0.3275	0.3520	0.3684	0.3848 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5740 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			9.0000	410.1300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17290.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.7207 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.9721	42.7244	42.4816	41.3411	41.1277	40.1343	40.1343	39.9504	40.5169	41.1277	41.5593	42.0106 (38)
Heat transfer coeff	122.3957	122.1479	121.9051	120.7646	120.5512	119.5579	119.5579	119.3739	119.9405	120.5512	120.9829	121.4342 (39)
Average = Sum(39)m / 12 =												120.7636 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3359	1.3332	1.3306	1.3181	1.3158	1.3049	1.3049	1.3029	1.3091	1.3158	1.3205	1.3254 (40)
HLP (average)												1.3181 (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	2.6473 (42)
Average daily hot water use (litres/day)	97.0722 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.6495	29.4301	30.3692	26.4766	25.4050	21.9226	20.3145	23.3111	23.5896	27.4914	30.0090	32.5878 (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	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	45.2279	43.7948	40.8189	36.7731	34.1465	30.4480	27.3044	31.3322	32.7633	36.9507	41.6791	43.8008	(72)
Total internal gains	371.9908	370.6063	357.6479	336.2635	313.5877	292.5019	279.2917	283.2709	294.6844	316.2106	340.9880	360.4970	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.9700	10.6334	0.4400	0.0000	0.7700		25.1101 (74)	
East					5.1600	19.6403	0.4400	0.0000	0.7700		34.3353 (76)	
South					0.4800	46.7521	0.4400	0.0000	0.7700		7.6030 (78)	
West					3.9300	19.6403	0.4400	0.0000	0.7700		26.1507 (80)	
Solar gains	93.1990	178.7618	292.2641	433.0968	543.4079	563.3956	533.3476	448.5373	341.2401	210.9529	115.4076	77.2434 (83)
Total gains	465.1898	549.3681	649.9121	769.3603	856.9956	855.8976	812.6392	731.8081	635.9244	527.1634	456.3956	437.7404 (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	39.2411	39.3207	39.3990	39.7711	39.8415	40.1725	40.1725	40.2344	40.0444	39.8415	39.6993	39.5518		
alpha	3.6161	3.6214	3.6266	3.6514	3.6561	3.6782	3.6782	3.6823	3.6696	3.6561	3.6466	3.6368		
util living area	0.9963	0.9929	0.9830	0.9521	0.8764	0.7402	0.5943	0.6624	0.8755	0.9752	0.9937	0.9971	(86)	
MIT	19.0715	19.2649	19.6211	20.1073	20.5465	20.8383	20.9470	20.9209	20.6676	20.0935	19.4964	19.0388	(87)	
Th 2	19.8128	19.8149	19.8170	19.8267	19.8285	19.8370	19.8370	19.8385	19.8337	19.8285	19.8248	19.8210	(88)	
util rest of house	0.9953	0.9909	0.9780	0.9367	0.8345	0.6506	0.4594	0.5295	0.8155	0.9646	0.9916	0.9963	(89)	
MIT 2	18.0610	18.2552	18.6103	19.0931	19.5040	19.7519	19.8202	19.8103	19.6261	19.0883	18.4941	18.0345	(90)	
Living area fraction	18.2545	18.4485	18.8038	19.2873	19.7036	19.9598	20.0359	20.0229	19.8255	fLA = Living area / (4) =				0.1914 (91)
MIT	18.2545	18.4485	18.8038	19.2873	19.7036	19.9598	20.0359	20.0229	19.8255	19.2807	18.6860	18.2267	(92)	
Temperature adjustment	18.2545	18.4485	18.8038	19.2873	19.7036	19.9598	20.0359	20.0229	19.8255	19.2807	18.6860	18.2267	0.0000	
adjusted MIT	18.2545	18.4485	18.8038	19.2873	19.7036	19.9598	20.0359	20.0229	19.8255	19.2807	18.6860	18.2267	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9876	0.9721	0.9277	0.8291	0.6612	0.4843	0.5529	0.8150	0.9578	0.9887	0.9947	(94)
Useful gains	462.1131	542.5604	631.7920	713.7174	710.5729	565.9373	393.5618	404.6054	518.2550	504.9235	451.2246	435.4123	(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	1707.9651	1654.9271	1499.8972	1254.4125	964.8426	640.8116	410.7909	432.4823	686.7228	1046.4717	1401.7098	1703.3254	(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	926.9138	747.5104	645.8702	389.3004	189.1767	0.0000	0.0000	0.0000	0.0000	402.9119	684.3493	943.3273	(98)
Space heating													4929.3601 (98)
Space heating per m2													53.8022 (99)
	(98) / (4) =												

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1123.8438	884.7281	907.2417	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7780	0.8473	0.8062	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	874.3049	749.6061	731.4424	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1100.6267	1047.9540	955.2615	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	162.9517	221.9708	166.5214	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			551.4439 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.7379	55.4927	41.6304	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												137.8610 (107)
Energy for space heating												1.5047 (108)
Energy for space cooling												53.8022 (99)
Total												1.5047 (108)
Dwelling Fabric Energy Efficiency (DFEE)												55.3069 (109)
												55.3 (109)

FULL SAP CALCULATION PRINTOUT

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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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1353 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3853 (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) =	0.3275 (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	0.4175	0.4094	0.4012	0.3602	0.3520	0.3111	0.3111	0.3029	0.3275	0.3520	0.3684	0.3848 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5740 (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)			16.5400	1.3258	21.9280		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.1800	20.5920		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Bay Roof/GRP	0.5300		0.5300	0.1300	0.0689		(30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.1671		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5960 (36)
Total fabric heat loss						(33) + (36) =	70.7631 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.9721	42.7244	42.4816	41.3411	41.1277	40.1343	40.1343	39.9504	40.5169	41.1277	41.5593	42.0106 (38)
Heat transfer coeff	113.7352	113.4875	113.2447	112.1042	111.8908	110.8974	110.8974	110.7135	111.2801	111.8908	112.3225	112.7738 (39)
Average = Sum(39)m / 12 =												112.1032 (39)
HLP	1.2414	1.2387	1.2360	1.2236	1.2212	1.2104	1.2104	1.2084	1.2146	1.2212	1.2260	1.2309 (40)
HLP (average)												1.2236 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)
Energy content (annual)										Total = Sum(45)m =		1527.3239 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.6495	29.4301	30.3692	26.4766	25.4050	21.9226	20.3145	23.3111	23.5896	27.4914	30.0090	32.5878 (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	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	45.2279	43.7948	40.8189	36.7731	34.1465	30.4480	27.3044	31.3322	32.7633	36.9507	41.6791	43.8008	(72)
Total internal gains	371.9908	370.6063	357.6479	336.2635	313.5877	292.5019	279.2917	283.2709	294.6844	316.2106	340.9880	360.4970	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9700	10.6334	0.6300	0.7000	0.7700	22.6504	(74)
East	5.1600	19.6403	0.6300	0.7000	0.7700	30.9720	(76)
South	0.4800	46.7521	0.6300	0.7000	0.7700	6.8583	(78)
West	3.9300	19.6403	0.6300	0.7000	0.7700	23.5891	(80)

Solar gains	84.0698	161.2513	263.6355	390.6730	490.1786	508.2085	481.1037	404.6010	307.8140	190.2891	104.1029	69.6771	(83)
Total gains	456.0605	531.8576	621.2835	726.9365	803.7664	800.7104	760.3954	687.8719	602.4984	506.4996	445.0909	430.1741	(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	55.9413	56.0634	56.1836	56.7552	56.8635	57.3728	57.3728	57.4682	57.1756	56.8635	56.6449	56.4183	
alpha	4.7294	4.7376	4.7456	4.7837	4.7909	4.8249	4.8249	4.8312	4.8117	4.7909	4.7763	4.7612	
util living area	0.9991	0.9980	0.9938	0.9759	0.9149	0.7749	0.6125	0.6860	0.9113	0.9894	0.9982	0.9993	(86)
MIT	19.5443	19.6923	19.9659	20.3455	20.6911	20.9095	20.9775	20.9620	20.7783	20.3296	19.8706	19.5204	(87)
Th 2	19.8870	19.8892	19.8913	19.9012	19.9030	19.9117	19.9117	19.9133	19.9084	19.9030	19.8993	19.8954	(88)
util rest of house	0.9988	0.9972	0.9914	0.9656	0.8773	0.6826	0.4754	0.5492	0.8557	0.9835	0.9974	0.9991	(89)
MIT 2	18.5588	18.7082	18.9824	19.3637	19.6878	19.8686	19.9059	19.9020	19.7758	19.3538	18.8946	18.5415	(90)
Living area fraction									fLA = Living area / (4) =			0.1914	(91)
MIT	18.7475	18.8966	19.1707	19.5517	19.8799	20.0678	20.1110	20.1049	19.9677	19.5406	19.0815	18.7289	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7475	18.8966	19.1707	19.5517	19.8799	20.0678	20.1110	20.1049	19.9677	19.5406	19.0815	18.7289	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	455.2925	529.8698	614.5956	698.8714	704.3705	558.3833	381.6858	395.8574	517.8186	496.7171	443.5786	429.6292	(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	1643.1910	1588.4390	1434.8888	1194.0995	915.2528	606.3702	389.3612	410.1835	652.9628	1000.3681	1345.7862	1638.4781	(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	883.7965	711.3586	610.2982	356.5643	156.8964	0.0000	0.0000	0.0000	0.0000	374.7163	649.5895	899.3835	(98)
Space heating												4642.6034	(98)
Space heating per m ²										(98) / (4) =		50.6724	(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	1042.4360	820.6411	841.4225	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8258	0.8950	0.8568	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	860.8396	734.4395	720.9060	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1036.1223	986.8898	903.9074	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

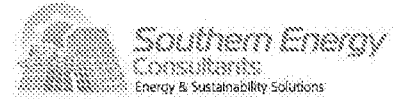


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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	126.2035	187.8230	136.1530	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												450.1796 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	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	31.5509	46.9558	34.0383	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												112.5449 (107)
Space cooling per m2												1.2284 (108)
Energy for space heating												50.6724 (99)
Energy for space cooling												1.2284 (108)
Total												51.9008 (109)
Target Fabric Energy Efficiency (TFEE)												59.7 (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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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)	=	0.3658 (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	0.3841	0.3658	0.3658	0.3384	0.3384	0.3018	0.3109	0.2926	0.3018	0.3201	0.3201	0.3475 (22b)
Effective ac	0.5738	0.5669	0.5669	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5604 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9912	41.4893	41.4893	40.7823	40.7823	39.9254	40.1304	39.7265	39.9254	40.3416	40.3416	41.0119 (38)
Heat transfer coeff	121.4147	120.9128	120.9128	120.2059	120.2059	119.3489	119.5540	119.1500	119.3489	119.7652	119.7652	120.4354 (39)
Average = Sum(39)m / 12 =												120.0850 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3252	1.3197	1.3197	1.3120	1.3120	1.3027	1.3049	1.3005	1.3027	1.3072	1.3072	1.3145 (40)
HLP (average)												1.3107 (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	2.6473 (42)
Average daily hot water use (litres/day)	97.0722 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (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											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (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	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308 (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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900 (71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815 (72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					6.9700	11.9814	0.4400		0.0000		0.7700		28.2934 (74)
East					5.1600	22.3313	0.4400		0.0000		0.7700		39.0398 (76)
South					0.4800	50.9848	0.4400		0.0000		0.7700		8.2914 (78)
West					3.9300	22.3313	0.4400		0.0000		0.7700		29.7338 (80)

Solar gains	105.3583	182.2906	295.0621	450.7959	550.5783	610.4755	571.8466	492.2556	373.5810	229.9180	133.7595	86.4100	(83)
Total gains	706.6550	778.9323	868.4577	988.0729	1050.7465	1077.4797	1019.5161	948.6494	850.8014	743.4787	687.7212	671.0616	(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	40.4965	40.6646	40.6646	40.9037	40.9037	41.1974	41.1267	41.2662	41.1974	41.0542	41.0542	40.8258
alpha	3.6998	3.7110	3.7110	3.7269	3.7269	3.7465	3.7418	3.7511	3.7465	3.7369	3.7369	3.7217
util living area	0.9845	0.9767	0.9536	0.8883	0.7522	0.5251	0.3582	0.3939	0.7015	0.9162	0.9731	0.9868 (86)
MIT	19.5149	19.6739	20.0171	20.4493	20.7934	20.9626	20.9935	20.9909	20.8847	20.4632	19.9282	19.4899 (87)
Th 2	19.8211	19.8254	19.8254	19.8314	19.8314	19.8388	19.8370	19.8405	19.8388	19.8352	19.8352	19.8295 (88)
util rest of house	0.9802	0.9704	0.9403	0.8559	0.6825	0.4151	0.2265	0.2551	0.5985	0.8839	0.9643	0.9831 (89)
MIT 2	17.8928	18.1250	18.6159	19.2165	19.6477	19.8195	19.8358	19.8385	19.7601	19.2532	18.5014	17.8623 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2033	18.4215	18.8842	19.4525	19.8670	20.0383	20.0574	20.0591	19.9754	19.4849	18.7746	18.1739 (92)
Temperature adjustment												
adjusted MIT	18.0533	18.2715	18.7342	19.3025	19.7170	19.8883	19.9074	19.9091	19.8254	19.3349	18.6246	18.0239 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9708	0.9583	0.9237	0.8379	0.6748	0.4201	0.2346	0.2636	0.5971	0.8659	0.9513	0.9747 (94)
Useful gains	686.0073	746.4872	802.2013	827.9450	709.0444	452.6025	239.1738	250.0334	508.0510	643.7753	654.2004	654.0727 (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												
	1572.7273	1532.1465	1370.4482	1130.2367	807.4246	464.0682	239.9932	251.3019	552.0349	926.3697	1272.4527	1556.4910 (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												
	659.7197	527.9631	422.7757	217.6500	73.1949	0.0000	0.0000	0.0000	0.0000	210.2503	445.1417	671.3992 (98)
Space heating												3228.0945 (98)
RHI space heating demand												3228 (98)

FULL SAP CALCULATION PRINTOUT

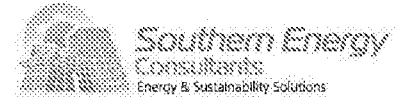
Calculation Type: New Build (As Designed)



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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) =	0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (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	44.5528	44.2437	43.9407	42.5176	42.2513	41.0119	41.0119	40.7823	41.4893	42.2513	42.7900	43.3531 (38)
Heat transfer coeff	123.9763	123.6672	123.3642	121.9411	121.6749	120.4354	120.4354	120.2059	120.9128	121.6749	122.2135	122.7766 (39)
Average = Sum(39)m / 12 =												121.9399 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3532	1.3498	1.3465	1.3309	1.3280	1.3145	1.3145	1.3120	1.3197	1.3280	1.3339	1.3401 (40)
HLP (average)												1.3309 (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	2.6473 (42)
Average daily hot water use (litres/day)	97.0722 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (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											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (65)
Total per year (kWh/year) = Sum(64)m =	1692.8195 (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	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			6.9700		10.6334		0.4400		0.0000		0.7700		25.1101 (74)
East			5.1600		19.6403		0.4400		0.0000		0.7700		34.3353 (76)
South			0.4800		46.7521		0.4400		0.0000		0.7700		7.6030 (78)
West			3.9300		19.6403		0.4400		0.0000		0.7700		26.1507 (80)
Solar gains	93.1990	178.7618	292.2641	433.0968	543.4079	563.3956	533.3476	448.5373	341.2401	210.9529	115.4076	77.2434	(83)
Total gains	694.4958	775.4034	865.6597	970.3738	1043.5761	1030.3998	981.0171	904.9311	818.4604	724.5136	669.3692	661.8950	(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	39.6597	39.7589	39.8565	40.3216	40.4099	40.8258	40.8258	40.9037	40.6646	40.4099	40.2318	40.0473
alpha	3.6440	3.6506	3.6571	3.6881	3.6940	3.7217	3.7217	3.7269	3.7110	3.6940	3.6821	3.6698
util living area	0.9875	0.9802	0.9624	0.9151	0.8176	0.6623	0.5136	0.5690	0.7952	0.9412	0.9801	0.9895 (86)
MIT	19.3446	19.5272	19.8558	20.2943	20.6654	20.8935	20.9686	20.9542	20.7791	20.2987	19.7482	19.3123 (87)
Th 2	19.7994	19.8020	19.8046	19.8167	19.8189	19.8295	19.8295	19.8314	19.8254	19.8189	19.8144	19.8096 (88)
util rest of house	0.9842	0.9750	0.9520	0.8907	0.7649	0.5691	0.3887	0.4422	0.7174	0.9192	0.9739	0.9867 (89)
MIT 2	17.6315	17.8974	18.3716	18.9953	19.4850	19.7528	19.8161	19.8097	19.6401	19.0166	18.2284	17.5911 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	17.9595	18.2095	18.6558	19.2440	19.7110	19.9712	20.0367	20.0288	19.8581	19.2620	18.5194	17.9206 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8095	18.0595	18.5058	19.0940	19.5610	19.8212	19.8867	19.8788	19.7081	19.1120	18.3694	17.7706 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9759	0.9639	0.9365	0.8719	0.7514	0.5683	0.3952	0.4477	0.7082	0.9013	0.9627	0.9794	(94)	
Useful gains	677.7733	747.4039	810.6870	846.0396	784.1604	585.6197	387.6670	405.1699	579.6740	652.9954	644.3724	648.2346	(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	1674.8566	1627.3939	1481.0810	1243.0631	956.4860	628.8122	395.8365	418.1720	678.0964	1035.6984	1377.2712	1666.1500	(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	741.8300	591.3532	498.7731	285.8570	128.2102	0.0000	0.0000	0.0000	0.0000	284.7310	527.6872	757.3291	(98)	
Space heating												3815.7708	(98)	
Space heating per m2												(98) / (4) =	41.6478	(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												4216.3213 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	741.8300	591.3532	498.7731	285.8570	128.2102	0.0000	0.0000	0.0000	0.0000	284.7310	527.6872	757.3291 (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)	819.7016	653.4290	551.1305	315.8641	141.6687	0.0000	0.0000	0.0000	0.0000	314.6199	583.0797	836.8277 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Efficiency of water heater	89.8785	89.8293	89.7127	89.4317	88.8385	87.3000	87.3000	87.3000	87.3000	89.4022	89.7535	87.3000 (216)
Fuel for water heating, kWh/month	191.9118	168.3774	175.0146	154.5238	150.3528	133.6702	125.4920	141.6911	142.6987	160.4380	172.5508	186.2880 (219)
Water heating fuel used												1903.0090 (219)
Annual totals kWh/year												
Space heating fuel - main system												4216.3213 (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)												389.0105 (232)
Total delivered energy for all uses												6583.3408 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4216.3213	3.4800	146.7280 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1903.0090	3.4800	66.2247 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	389.0105	13.1900	51.3105 (250)
Additional standing charges			120.0000 (251)
Total energy cost			394.1557 (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] =	1.2117 (257)
SAP value		83.0965
SAP rating (Section 12)		83 (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	4216.3213	0.2160	910.7254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.0090	0.2160	411.0499 (264)
Space and water heating			1321.7753 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total kg/year			1562.5968 (272)
CO2 emissions per m2			17.0600 (273)
EI value			84.6737
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8883 = 3.918$, stars = 4
Water heating environmental impact	$0.216 / 0.8883 = 0.2432$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) =	0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.3841	0.3658	0.3658	0.3384	0.3384	0.3018	0.3109	0.2926	0.3018	0.3201	0.3201	0.3475 (22b)
Effective ac	0.5738	0.5669	0.5669	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5604 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9912	41.4893	41.4893	40.7823	40.7823	39.9254	40.1304	39.7265	39.9254	40.3416	40.3416	41.0119 (38)
Heat transfer coeff	121.4147	120.9128	120.9128	120.2059	120.2059	119.3489	119.5540	119.1500	119.3489	119.7652	119.7652	120.4354 (39)
Average = Sum(39)m / 12 =												120.0850 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3252	1.3197	1.3197	1.3120	1.3120	1.3027	1.3049	1.3005	1.3027	1.3072	1.3072	1.3145 (40)
HLP (average)												1.3107 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (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											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (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	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.9700	11.9814		0.4400		0.0000		0.7700		28.2934 (74)
East				5.1600	22.3313		0.4400		0.0000		0.7700		39.0398 (76)
South				0.4800	50.9848		0.4400		0.0000		0.7700		8.2914 (78)
West				3.9300	22.3313		0.4400		0.0000		0.7700		29.7338 (80)
Solar gains	105.3583	182.2906	295.0621	450.7959	550.5783	610.4755	571.8466	492.2556	373.5810	229.9180	133.7595		86.4100 (83)
Total gains	706.6550	778.9323	868.4577	988.0729	1050.7465	1077.4797	1019.5161	948.6494	850.8014	743.4787	687.7212		671.0616 (84)

7. Mean internal temperature (heating season)

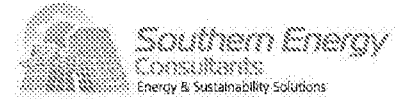
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.4965	40.6646	40.6646	40.9037	40.9037	41.1974	41.1267	41.2662	41.1974	41.0542	41.0542	40.8258
alpha	3.6998	3.7110	3.7110	3.7269	3.7269	3.7465	3.7418	3.7511	3.7465	3.7369	3.7369	3.7217
util living area	0.9845	0.9767	0.9536	0.8883	0.7522	0.5251	0.3582	0.3939	0.7015	0.9162	0.9731	0.9868 (86)
MIT	19.5149	19.6739	20.0171	20.4493	20.7934	20.9626	20.9935	20.9909	20.8847	20.4632	19.9282	19.4899 (87)
Th 2	19.8211	19.8254	19.8254	19.8314	19.8314	19.8388	19.8370	19.8405	19.8388	19.8352	19.8352	19.8295 (88)
util rest of house	0.9802	0.9704	0.9403	0.8559	0.6825	0.4151	0.2265	0.2551	0.5985	0.8839	0.9643	0.9831 (89)
MIT 2	17.8928	18.1250	18.6159	19.2165	19.6477	19.8195	19.8358	19.8385	19.7601	19.2532	18.5014	17.8623 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	18.2033	18.4215	18.8842	19.4525	19.8670	20.0383	20.0574	20.0591	19.9754	19.4849	18.7746	18.1739 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0533	18.2715	18.7342	19.3025	19.7170	19.8883	19.9074	19.9091	19.8254	19.3349	18.6246	18.0239 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9708	0.9583	0.9237	0.8379	0.6748	0.4201	0.2346	0.2636	0.5971	0.8659	0.9513	0.9747 (94)
Useful gains	686.0073	746.4872	802.2013	827.9450	709.0444	452.6025	239.1738	250.0334	508.0510	643.7753	654.2004	654.0727 (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	1572.7273	1532.1465	1370.4482	1130.2367	807.4246	464.0682	239.9932	251.3019	552.0349	926.3697	1272.4527	1556.4910 (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	659.7197	527.9631	422.7757	217.6500	73.1949	0.0000	0.0000	0.0000	0.0000	210.2503	445.1417	671.3992 (98)
Space heating												3228.0945 (98)
Space heating per m2												(98) / (4) = 35.2335 (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												3566.9552 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	659.7197	527.9631	422.7757	217.6500	73.1949	0.0000	0.0000	0.0000	0.0000	210.2503	445.1417	671.3992 (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)	728.9720	583.3846	467.1555	240.4972	80.8783	0.0000	0.0000	0.0000	0.0000	232.3207	491.8693	741.8776 (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	172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Efficiency of water heater (217)m	89.8176	89.7673	89.6105	89.2298	88.4066	87.3000	87.3000	87.3000	87.3000	89.1744	89.6518	87.3000 (216)
Fuel for water heating, kWh/month	192.0418	168.4938	175.2141	154.8734	151.0873	133.6702	125.4920	141.6911	142.6987	160.8478	172.7466	186.4139 (219)
Water heating fuel used												1905.2707 (219)
Annual totals kWh/year												
Space heating fuel - main system												3566.9552 (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)												389.0105 (232)
Total delivered energy for all uses												5936.2364 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3566.9552	3.8700	138.0412 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1905.2707	3.8700	73.7340 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	389.0105	18.9000	73.5230 (250)
Additional standing charges			93.0000 (251)
Total energy cost			392.4731 (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	3566.9552	0.2160	770.4623 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1905.2707	0.2160	411.5385 (264)
Space and water heating			1182.0008 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total kg/year			1422.8222 (272)

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

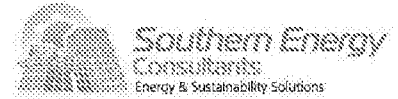
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3566.9552	1.2200	4351.6854 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1905.2707	1.2200	2324.4302 (264)
Space and water heating			6676.1156 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	389.0105	3.0700	1194.2622 (268)
Primary energy kWh/year			8100.6278 (272)
Primary energy kWh/m2/year			88.4155 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-187 kg (13.1%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (76.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.04 kg/m²	B 84 B 86
Solar photovoltaic panels	£345	10.33 kg/m²	A 94 A 95
Total Savings	£373	12.37 kg/m²	

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

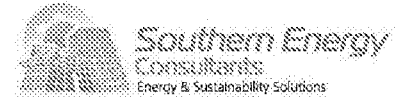
Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£88	£97	-£9
Mains gas	£305	£267	£38
Space heating	£245	£245	£0
Water heating	£74	£45	£29
Lighting	£74	£74	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£393	£19	£374
Total cost of uses	£393	£19	£374
Delivered energy	65 kWh/m²	35 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	16 kg/m²	3 kg/m²	12 kg/m²
Primary energy	88 kWh/m²	16 kWh/m²	73 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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (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	44.5528	44.2437	43.9407	42.5176	42.2513	41.0119	41.0119	40.7823	41.4893	42.2513	42.7900	43.3531 (38)
Heat transfer coeff	123.9763	123.6672	123.3642	121.9411	121.6749	120.4354	120.4354	120.2059	120.9128	121.6749	122.2135	122.7766 (39)
Average = Sum(39)m / 12 =												121.9399 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3532	1.3498	1.3465	1.3309	1.3280	1.3145	1.3145	1.3120	1.3197	1.3280	1.3339	1.3401 (40)
HLP (average)												1.3309 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1079.5246 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1813.6014 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.1874 (H8)
Collector performance factor											0.5692 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											97.0722 (H14)
Solar storage volume factor											0.7726 (H15)
Solar input											0.9484 (H16)
Solar input	-24.9641	-41.6579	-70.9482	-95.0845	-117.4689	-115.4907	-113.9644	-99.5713	-77.9843	-53.2541	-29.6110 (H17)
Output from w/h											-860.8902 (H17)
147.5233	109.5944	86.0621	43.1087	16.1022	1.2034	0.0000	24.1250	46.5916	90.1810	125.2594	146.5882 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	836.3393 (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	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.9700	10.6334	0.4400	0.0000	0.7700	25.1101 (74)
East	5.1600	19.6403	0.4400	0.0000	0.7700	34.3353 (76)
South	0.4800	46.7521	0.4400	0.0000	0.7700	7.6030 (78)
West	3.9300	19.6403	0.4400	0.0000	0.7700	26.1507 (80)

Solar gains	93.1990	178.7618	292.2641	433.0968	543.4079	563.3956	533.3476	448.5373	341.2401	210.9529	115.4076	77.2434 (83)
Total gains	694.4958	775.4034	865.6597	970.3738	1043.5761	1030.3998	981.0171	904.9311	818.4604	724.5136	669.3692	661.8950 (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	39.6597	39.7589	39.8565	40.3216	40.4099	40.8258	40.8258	40.9037	40.6646	40.4099	40.2318	40.0473
alpha	3.6440	3.6506	3.6571	3.6881	3.6940	3.7217	3.7217	3.7269	3.7110	3.6940	3.6821	3.6698
util living area	0.9875	0.9802	0.9624	0.9151	0.8176	0.6623	0.5136	0.5690	0.7952	0.9412	0.9801	0.9895 (86)
MIT	19.3446	19.5272	19.8558	20.2943	20.6654	20.8935	20.9686	20.9542	20.7791	20.2987	19.7482	19.3123 (87)
Th 2	19.7994	19.8020	19.8046	19.8167	19.8189	19.8295	19.8295	19.8314	19.8254	19.8189	19.8144	19.8096 (88)
util rest of house	0.9842	0.9750	0.9520	0.8907	0.7649	0.5691	0.3887	0.4422	0.7174	0.9192	0.9739	0.9867 (89)
MIT 2	17.6315	17.8974	18.3716	18.9953	19.4850	19.7528	19.8161	19.8097	19.6401	19.0166	18.2284	17.5911 (90)
Living area fraction												0.1914 (91)
MIT	17.9595	18.2095	18.6558	19.2440	19.7110	19.9712	20.0367	20.0288	19.8581	19.2620	18.5194	17.9206 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8095	18.0595	18.5058	19.0940	19.5610	19.8212	19.8867	19.8788	19.7081	19.1120	18.3694	17.7706 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Calculation of Energy Ratings for Improved Dwelling 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9759	0.9639	0.9365	0.8719	0.7514	0.5683	0.3952	0.4477	0.7082	0.9013	0.9627	0.9794	(94)
Useful gains	677.7733	747.4039	810.6870	846.0396	784.1604	585.6197	387.6670	405.1699	579.6740	652.9954	644.3724	648.2346	(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	1674.8566	1627.3939	1481.0810	1243.0631	956.4860	628.8122	395.8365	418.1720	678.0964	1035.6984	1377.2712	1666.1500	(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	741.8300	591.3532	498.7731	285.8570	128.2102	0.0000	0.0000	0.0000	0.0000	284.7310	527.6872	757.3291	(98)
Space heating												3815.7708	(98)
Space heating per m2											(98) / (4) =	41.6478	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4216.3213	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	741.8300	591.3532	498.7731	285.8570	128.2102	0.0000	0.0000	0.0000	0.0000	284.7310	527.6872	757.3291	(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)	819.7016	653.4290	551.1305	315.8641	141.6687	0.0000	0.0000	0.0000	0.0000	314.6199	583.0797	836.8277	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	147.5233	109.5944	86.0621	43.1087	16.1022	1.2034	0.0000	24.1250	46.5916	90.1810	125.2594	146.5882	(64)	
Efficiency of water heater	89.9531	89.9843	90.0145	90.0674	90.1314	87.3000	87.3000	87.3000	87.3000	89.7090	89.8681	87.3000	(216)	
(217)m	89.9531	89.9843	90.0145	90.0674	90.1314	87.3000	87.3000	87.3000	87.3000	89.7090	89.8681	89.9652	(217)	
Fuel for water heating, kWh/month	164.0003	121.7928	95.6091	47.8627	17.8653	1.3784	0.0000	27.6346	53.3696	100.5261	139.3814	162.9388	(219)	
Water heating fuel used												932.3592	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4216.3213	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
pump for solar water heating												50.0000	(230g)	
Total electricity for the above, kWh/year												125.0000	(231)	
Electricity for lighting (calculated in Appendix L)												389.0105	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =												-1727.2394	(233)	
Total delivered energy for all uses												3935.4515	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4216.3213	3.4800	146.7280	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	932.3592	3.4800	32.4461	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	389.0105	13.1900	51.3105	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			139.1492	(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] =	0.4278	(257)
SAP value		94.0325	
SAP rating (Section 12)		94	(258)
SAP band		A	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4216.3213	0.2160	910.7254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	932.3592	0.2160	201.3896	(264)
Space and water heating			1112.1150	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	389.0105	0.5190	201.8964	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			482.4492	(272)
CO2 emissions per m2			5.2700	(273)
EI value			95.2680	
EI rating			95	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	221.7732 (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) =	0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.3841	0.3658	0.3658	0.3384	0.3384	0.3018	0.3109	0.2926	0.3018	0.3201	0.3201	0.3475 (22b)
Effective ac	0.5738	0.5669	0.5669	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5604 (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)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9912	41.4893	41.4893	40.7823	40.7823	39.9254	40.1304	39.7265	39.9254	40.3416	40.3416	41.0119 (38)
Heat transfer coeff	121.4147	120.9128	120.9128	120.2059	120.2059	119.3489	119.5540	119.1500	119.3489	119.7652	119.7652	120.4354 (39)
Average = Sum(39)m / 12 =												120.0850 (39)
HLP	1.3252	1.3197	1.3197	1.3120	1.3120	1.3027	1.3049	1.3005	1.3027	1.3072	1.3072	1.3145 (40)
HLP (average)												1.3107 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1140.0998 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1915.3676 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.2541 (H8)
Collector performance factor											0.5495 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											97.0722 (H14)
Solar storage volume factor											0.7726 (H15)
Solar input											0.9484 (H16)
Solar input	-27.0155	-40.6042	-68.3826	-94.5257	-113.8407	-119.8124	-116.9355	-104.4241	-81.5034	-55.4452	-32.8380 (H17)
Solar input (sum of months) = Sum(63)m =											-877.7100 (63)
Output from w/h											
145.4719	110.6481	88.6276	43.6675	19.7304	0.0000	0.0000	19.2722	43.0725	87.9898	122.0324	145.0964 (64)
Total per year (kWh/year) = Sum(64)m =											825.6089 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (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	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(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)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.9700	11.9814	0.4400	0.0000	0.7700	28.2934 (74)
East	5.1600	22.3313	0.4400	0.0000	0.7700	39.0398 (76)
South	0.4800	50.9848	0.4400	0.0000	0.7700	8.2914 (78)
West	3.9300	22.3313	0.4400	0.0000	0.7700	29.7338 (80)

Solar gains	105.3583	182.2906	295.0621	450.7959	550.5783	610.4755	571.8466	492.2556	373.5810	229.9180	133.7595	86.4100 (83)
Total gains	706.6550	776.9323	868.4577	988.0729	1050.7465	1077.4797	1019.5161	948.6494	850.8014	743.4787	687.7212	671.0616 (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	40.4965	40.6646	40.6646	40.9037	40.9037	41.1974	41.1267	41.2662	41.1974	41.0542	41.0542	40.8258
alpha	3.6998	3.7110	3.7110	3.7269	3.7269	3.7465	3.7418	3.7511	3.7465	3.7369	3.7369	3.7217
util living area	0.9845	0.9767	0.9536	0.8883	0.7522	0.5251	0.3582	0.3939	0.7015	0.9162	0.9731	0.9868 (86)
MIT	19.5149	19.6739	20.0171	20.4493	20.7934	20.9626	20.9935	20.9909	20.8847	20.4632	19.9282	19.4899 (87)
Th 2	19.8211	19.8254	19.8254	19.8314	19.8314	19.8388	19.8370	19.8405	19.8388	19.8352	19.8352	19.8295 (88)
util rest of house	0.9802	0.9704	0.9403	0.8559	0.6825	0.4151	0.2265	0.2551	0.5985	0.8839	0.9643	0.9831 (89)
MIT 2	17.8928	18.1250	18.6159	19.2165	19.6477	19.8195	19.8358	19.8385	19.7601	19.2532	18.5014	17.8623 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	18.2033	18.4215	18.8842	19.4525	19.8670	20.0383	20.0574	20.0591	19.9754	19.4849	18.7746	18.1739 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0533	18.2715	18.7342	19.3025	19.7170	19.8883	19.9074	19.9091	19.8254	19.3349	18.6246	18.0239 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9708	0.9583	0.9237	0.8379	0.6748	0.4201	0.2346	0.2636	0.5971	0.8659	0.9513	0.9747	(94)
Useful gains	686.0073	746.4872	802.2013	827.9450	709.0444	452.6025	239.1738	250.0334	508.0510	643.7753	654.2004	654.0727	(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	1572.7273	1532.1465	1370.4482	1130.2367	807.4246	464.0682	239.9932	251.3019	552.0349	926.3697	1272.4527	1556.4910	(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	659.7197	527.9631	422.7757	217.6500	73.1949	0.0000	0.0000	0.0000	0.0000	210.2503	445.1417	671.3992	(98)
Space heating												3228.0945	(98)
Space heating per m2											(98) / (4) =	35.2335	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3566.9552	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	659.7197	527.9631	422.7757	217.6500	73.1949	0.0000	0.0000	0.0000	0.0000	210.2503	445.1417	671.3992	(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)	728.9720	583.3846	467.1555	240.4972	80.8783	0.0000	0.0000	0.0000	0.0000	232.3207	491.8693	741.8776	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	145.4719	110.6481	88.6276	43.6675	19.7304	0.0000	0.0000	19.2722	43.0725	87.9898	122.0324	145.0964	(64)	
Efficiency of water heater	89.9046	89.9289	89.9287	89.9490	89.8011	87.3000	87.3000	87.3000	87.3000	89.5318	89.7918	87.3000	(216)	
Fuel for water heating, kWh/month	161.8070	123.0396	98.5532	48.5469	21.9712	0.0000	0.0000	22.0758	49.3385	98.2778	135.9058	161.3719	(219)	
Water heating fuel used												920.8878	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3566.9552	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													389.0105	(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													3177.6938	(238)

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

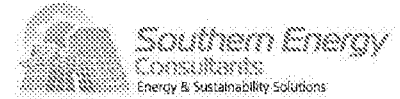
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3566.9552	3.8700	138.0412	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	920.8878	3.8700	35.6384	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	389.0105	18.9000	73.5230	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			19.0613	(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	3566.9552	0.2160	770.4623	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	920.8878	0.2160	198.9118	(264)
Space and water heating			969.3741	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	389.0105	0.5190	201.8964	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			289.4067 (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	3566.9552	1.2200	4351.6854 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	920.8878	1.2200	1123.4831 (264)
Space and water heating			5475.1684 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	389.0105	3.0700	1194.2622 (268)

Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1453.0105 (272)
Primary energy kWh/m2/year			15.8591 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	193.2 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	292.74 (P1)
Transmission heat loss coefficient	79.42 (37)
Summer heat loss coefficient	372.16 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.9700	81.1852	0.4400	0.0000	0.9000	224.0808
East	5.1600	117.5071	0.4400	0.0000	0.9000	240.1092
South	0.4800	112.2060	0.4400	0.0000	0.9000	21.3281
West	3.9300	117.5071	0.4400	0.0000	0.9000	182.8739
total:						668.3921

	Jun	Jul	Aug	
Solar gains	714	668	575	(P4)
Internal gains	464	445	453	
Total summer gains	1178	1113	1029	(P5)
Summer gain/loss ratio	3.16	2.99	2.76	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 193.2)	0.65	0.65	0.65	
Threshold temperature	19.81	21.54	21.21	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			