

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG004			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Cl Ea Ga		
Property	Lockwood, Plot 28				
SAP Rating	83 B	DER	18.20	TET	18.73
Environmental	85 B	% DER<TET	2.82		
CO ₂ Emissions (t/year)	1.37	DPEE	52.60	TPEE	57.42
General Requirements Compliance	Pass	% DPEE<TPEE	8.41		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 91 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) 18.73 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.20 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 57.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 52.6 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North East: 1.37 m², No overhang
Windows facing South East: 6.97 m², No overhang
Windows facing North West: 8.18 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	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	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) =	0.1814 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4314 (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) =		0.3667 (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												
Effective ac	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8567		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 17548.3500 (34)												
192.5428 (35)												
9.2013 (36)												
(33) + (36) = 77.0581 (37)												
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Average = Sum(39)m / 12 =	121.4035	121.0946	120.7919	119.3701	119.1040	117.8657	117.8657	117.6363	118.3427	119.1040	119.6422	120.2048 (39)
												119.3688 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3321	1.3287	1.3253	1.3097	1.3068	1.2932	1.2932	1.2907	1.2985	1.3068	1.3127	1.3189 (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	2.6410 (42)											
Average daily hot water use (litres/day)	96.9239 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy content (annual)	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
	Total = Sum(45)m = 1524.9898 (45)											

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9345	19.4820	15.8438	11.9948	8.9663	7.5697	8.1793	10.6318	14.2700	18.1190	21.1475	22.5441 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	404.1192	401.9263	387.3229	363.7127	339.6230	316.5078	301.5578	307.8138	320.0013	343.8328	371.2098	391.8547 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				1.3700	11.2829	0.4400	0.0000	0.7700		5.2370 (75)		
Southeast				6.9700	36.7938	0.4400	0.0000	0.7700		86.8863 (77)		
Northwest				8.1800	11.2829	0.4400	0.0000	0.7700		31.2694 (81)		
Solar gains	123.3927	222.3093	336.3821	470.7804	576.5898	594.0953	563.7511	481.4988	382.4021	254.3835	150.0042	104.1695 (83)
Total gains	527.5119	624.2356	723.7049	834.4931	916.2128	910.6032	865.3090	789.3126	702.4034	598.2163	521.2141	496.0242 (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	40.1516	40.2540	40.3549	40.8355	40.9268	41.3568	41.3568	41.4374	41.1901	40.9268	40.7427	40.5520
alpha	3.6768	3.6836	3.6903	3.7224	3.7285	3.7571	3.7571	3.7625	3.7460	3.7285	3.7162	3.7035
util living area	0.9948	0.9897	0.9771	0.9408	0.8562	0.7099	0.5609	0.6231	0.8443	0.9646	0.9908	0.9958 (86)
MIT	19.1814	19.3871	19.7343	20.1983	20.6067	20.8684	20.9594	20.9398	20.7275	20.1949	19.6066	19.1486 (87)
Th 2	19.8158	19.8184	19.8210	19.8332	19.8355	19.8461	19.8461	19.8461	19.8420	19.8355	19.8309	19.8261 (88)
util rest of house	0.9933	0.9869	0.9705	0.9224	0.8100	0.6185	0.4304	0.4926	0.7760	0.9501	0.9877	0.9947 (89)
MIT 2	17.4057	17.7067	18.2115	18.8797	19.4312	19.7477	19.8280	19.8180	19.6020	18.8881	18.0361	17.3643 (90)
Living area fraction	17.7474	18.0301	18.5046	19.1334	19.6575	19.9633	20.0457	20.0339	19.8186	19.1396	18.3384	17.7077 (92)
MIT	17.5974	17.8801	18.3546	18.9834	19.5075	19.8133	19.8957	19.8839	19.6686	18.9896	18.1884	17.5577 (93)
Temperature adjustment												-0.1500
adjusted MIT												17.5577 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	521.6684	611.5291	693.6302	754.9224	727.7667	560.5923	377.6525	392.3311	536.2329	559.3280	511.2638	491.5836 (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	1614.3562	1571.8178	1431.9362	1203.6594	929.9000	614.4745	388.4527	409.8370	659.0048	999.2342	1326.6358	1605.6575 (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	812.9598	645.3141	549.2997	323.0906	150.3872	0.0000	0.0000	0.0000	0.0000	327.2902	587.0678	828.8710 (98)
Space heating												4224.2804 (98)
Space heating per m ²												(98) / (4) = 46.3494 (99)

8c. Space cooling requirement

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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													4667.7131 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	812.9598	645.3141	549.2997	323.0906	150.3872	0.0000	0.0000	0.0000	0.0000	327.2902	587.0678	828.8710	(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)	898.2981	713.0542	606.9610	357.0062	166.1737	0.0000	0.0000	0.0000	0.0000	361.6466	648.6937	915.8796	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)
Efficiency of water heater (217)m	89.9237	89.8752	89.7693	89.5179	88.9671	87.3000	87.3000	87.3000	87.3000	89.5013	89.8136	87.3000	(216)
Fuel for water heating, kWh/month	191.5455	168.0555	174.6596	154.1612	149.9291	133.4888	125.3239	141.4982	142.5034	160.0384	172.1945	185.9373	(219)
Water heating fuel used													1899.3356 (219)
Annual totals kWh/year													
Space heating fuel - main system													4667.7131 (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)													387.3697 (232)
Total delivered energy for all uses													7029.4184 (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	4667.7131	0.2160	1008.2260 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1899.3356	0.2160	410.2565 (264)
Space and water heating			1418.4825 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.3697	0.5190	201.0449 (268)
Total CO2, kg/year			1658.4524 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2000 (273)

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

DER		18.2000 ZC1
Total Floor Area	TFA	91.1400
Assumed number of occupants	N	2.6410
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.6798 ZC2
CO2 emissions from cooking, equation (L16)		2.0011 ZC3
Total CO2 emissions		35.8810 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		35.8810 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	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (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)			16.5200	1.3258	21.9015		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Clad Cavity	132.7600	20.8200	111.9400	0.1800	20.1492		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Total net area of external elements Aum(A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6289		(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)							11.1506 (36)
Total fabric heat loss						(33) + (36) =	69.7795 (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	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	112.5409	112.2936	112.0511	110.9125	110.6994	109.7077	109.7077	109.5240	110.0897	110.6994	111.1304	111.5810 (39)
Average = Sum(39)m / 12 =												110.9114 (39)
HLP	1.2348	1.2321	1.2294	1.2169	1.2146	1.2037	1.2037	1.2017	1.2079	1.2146	1.2193	1.2243 (40)
HLP (average)												1.2169 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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)

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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	50.3792	46.8421	46.4279	43.0183	44.4522	46.4279	46.8421	50.3792	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (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	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Heat gains from water heating, kWh/month	65.3109	57.4859	60.0411	53.0754	51.2975	45.0045	42.8506	48.0263	48.5648	55.5449	59.2122	63.6521 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9345	19.4820	15.8438	11.9948	8.9663	7.5697	8.1793	10.6318	14.2700	18.1190	21.1475	22.5441 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	87.7835	85.5446	80.7004	73.7158	68.9483	62.5062	57.5949	64.5515	67.4512	74.6572	82.2392	85.5539 (72)
Total internal gains	416.4925	414.3036	399.5151	375.2563	350.5135	326.7473	311.8051	318.7116	331.5556	356.0358	383.5931	404.2320 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				1.3700	11.2829	0.6300	0.7000	0.7700	4.7241 (75)			
Southeast				6.9700	36.7938	0.6300	0.7000	0.7700	78.3754 (77)			
Northwest				8.1800	11.2829	0.6300	0.7000	0.7700	28.2064 (81)			
Solar gains	111.3058	200.5331	303.4319	424.6653	520.1102	535.9010	508.5291	434.3338	344.9441	229.4655	135.3106	93.9656 (83)
Total gains	527.7983	614.8367	702.9470	799.9216	870.6237	862.6484	820.3342	753.0454	676.4998	585.5012	518.9037	498.1976 (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	56.2388	56.3627	56.4846	57.0645	57.1743	57.6912	57.6912	57.7879	57.4910	57.1743	56.9526	56.7226
alpha	4.7493	4.7575	4.7656	4.8043	4.8116	4.8461	4.8461	4.8525	4.8327	4.8116	4.7968	4.7815
util living area	0.9983	0.9961	0.9894	0.9646	0.8893	0.7341	0.5690	0.6342	0.8728	0.9806	0.9964	0.9987 (86)
MIT	19.6275	19.7862	20.0561	20.4193	20.7401	20.9298	20.9837	20.9732	20.8275	20.4122	19.9543	19.6000 (87)
Th 2	19.8923	19.8944	19.8965	19.9065	19.9083	19.9170	19.9170	19.9186	19.9137	19.9083	19.9046	19.9006 (88)
util rest of house	0.9977	0.9947	0.9855	0.9505	0.8451	0.6396	0.4388	0.5019	0.8048	0.9704	0.9950	0.9982 (89)
MIT 2	18.0668	18.3000	18.6939	19.2199	19.6505	19.8698	19.9111	19.9075	19.7709	19.2188	18.5532	18.0324 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.3671	18.5861	18.9561	19.4508	19.8602	20.0738	20.1175	20.1126	19.9743	19.4485	18.8228	18.3341 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3671	18.5861	18.9561	19.4508	19.8602	20.0738	20.1175	20.1126	19.9743	19.4485	18.8228	18.3341 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9964	0.9923	0.9807	0.9428	0.8428	0.6546	0.4639	0.5271	0.8094	0.9644	0.9927	0.9972 (94)
Ext temp.	525.8862	610.0920	689.4091	754.1981	733.7876	564.6640	380.5459	396.9545	547.5369	564.6519	515.1116	496.8168 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1583.1281	1536.8571	1395.7198	1170.2102	903.3256	600.5208	385.8983	406.6202	646.6965	979.5230	1302.7633	1577.0981 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m ²	786.5879	622.7861	525.4952	299.5287	126.1363	0.0000	0.0000	0.0000	0.0000	308.6641	567.1092	803.7293 (98)
												4040.0368 (98)
												44.3278 (99)

8c. Space cooling requirement

Not applicable

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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													4325.5212 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	786.5879	622.7861	525.4952	299.5287	126.1363	0.0000	0.0000	0.0000	0.0000	308.6641	567.1092	803.7293	(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)	842.1712	666.7946	562.6286	320.6946	135.0496	0.0000	0.0000	0.0000	0.0000	330.4755	607.1833	860.5238	(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	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789	(64)
Efficiency of water heater (217)m	88.0739	87.8759	87.4447	86.4449	84.3730	80.3000	80.3000	80.3000	80.3000	86.4032	87.6305	88.1547	(216)
Fuel for water heating, kWh/month	237.3777	209.7393	220.7964	198.1003	196.5060	181.8500	174.2262	194.2213	196.3663	207.8078	217.1822	231.5008	(219)
Water heating fuel used												2465.6742	(219)
Annual totals kWh/year													
Space heating fuel - main system												4325.5212	(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)												387.3697	(232)
Total delivered energy for all uses												7253.5652	(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	4325.5212	0.2160	934.3126 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2465.6742	0.2160	532.5856 (264)
Space and water heating			1466.8982 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.3697	0.5190	201.0449 (268)
Total CO2, kg/m2/year			1706.8681 (272)
Emissions per m2 for space and water heating			16.0950 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2059 (272b)
Emissions per m2 for pumps and fans			0.4271 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0950 * 1.00) + 2.2059 + 0.4271, rounded to 2 d.p.			18.7300 (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	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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)	=	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum(A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8567		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Average = Sum(39)m / 12 =	119.8194	119.5721	119.3297	118.1910	117.9780	116.9863	116.9863	116.8026	117.3683	117.9780	118.4090	118.8595 (39)
HLP	1.3147	1.3120	1.3093	1.2968	1.2945	1.2836	1.2836	1.2816	1.2878	1.2945	1.2992	1.3041 (40)
HLP (average)												1.2968 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy content (annual)	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Total = Sum(45)m =												1524.9898 (45)

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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	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9345	19.4820	15.8438	11.9948	8.9663	7.5697	8.1793	10.6318	14.2700	18.1190	21.1475	22.5441	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8678	369.4869	356.5712	335.2575	312.6595	291.6426	278.4728	282.4444	293.8177	315.2729	339.9693	359.4119	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			1.3700	11.2829	0.4400	0.0000	0.7700	5.2370 (75)				
Southeast			6.9700	36.7938	0.4400	0.0000	0.7700	86.8863 (77)				
Northwest			8.1800	11.2829	0.4400	0.0000	0.7700	31.2694 (81)				
Solar gains	123.3927	222.3093	336.3821	470.7804	576.5898	594.0953	563.7511	481.4988	382.4021	254.3835	150.0042	104.1695 (83)
Total gains	494.2605	591.7962	692.9532	806.0378	889.2493	885.7379	842.2239	763.9432	676.2198	569.6564	489.9736	463.5814 (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	39.7316	39.8138	39.8947	40.2790	40.3517	40.6938	40.6938	40.7578	40.5614	40.3517	40.2049	40.0525	
alpha	3.6488	3.6543	3.6596	3.6853	3.6901	3.7129	3.7129	3.7172	3.7041	3.6901	3.6803	3.6702	
util living area	0.9954	0.9907	0.9786	0.9434	0.8607	0.7172	0.5688	0.6337	0.8520	0.9675	0.9918	0.9964	(86)
MIT	19.1357	19.3449	19.6986	20.1694	20.5883	20.8589	20.9556	20.9338	20.7096	20.1614	19.5621	19.0993	(87)
Th 2	19.8294	19.8315	19.8336	19.8433	19.8452	19.8537	19.8537	19.8553	19.8504	19.8452	19.8415	19.8376	(88)
util rest of house	0.9942	0.9881	0.9725	0.9260	0.8162	0.6273	0.4387	0.5038	0.7867	0.9544	0.9892	0.9954	(89)
MIT 2	18.1376	18.3473	18.6991	19.1649	19.5533	19.7803	19.8398	19.8320	19.6728	19.1663	18.5720	18.1074	(90)
Living area fraction	18.3297	18.5393	18.8914	19.3582	19.7525	19.9879	20.0545	20.0441	19.8723	19.3578	18.7626	18.2983	(91)
Temperature adjustment	18.3297	18.5393	18.8914	19.3582	19.7525	19.9879	20.0545	20.0441	19.8723	19.3578	18.7626	18.2983	(92)
adjusted MIT	18.3297	18.5393	18.8914	19.3582	19.7525	19.9879	20.0545	20.0441	19.8723	19.3578	18.7626	18.2983	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	490.2383	582.4311	669.2743	738.9809	722.0593	565.9687	389.9270	402.7573	532.9653	539.4019	482.9411	460.5731	(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	1681.0295	1630.8777	1478.6651	1236.0624	950.0204	630.3123	404.1325	425.6379	677.4843	1033.2277	1380.9540	1675.7169	(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	885.9486	704.5562	602.1868	357.8987	169.6031	0.0000	0.0000	0.0000	0.0000	367.4064	646.5692	904.0670	(98)
Space heating												4638.2360	(98)
Space heating per m2												50.8913	(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	1099.6708	865.6983	887.6997	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8002	0.8658	0.8296	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	879.9072	749.5151	736.4389	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1135.1887	1082.2252	992.5039	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	183.8026	247.5363	190.5123	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			621.8513 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.9507	61.8841	47.6281	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												155.4628 (107)
Energy for space heating												1.7058 (108)
Energy for space cooling												50.8913 (99)
Total												1.7058 (108)
Dwelling Fabric Energy Efficiency (DFEE)												52.5971 (109)
												52.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (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)			16.5200	1.3258	21.9015		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Clad Cavity	132.7600	20.8200	111.9400	0.1800	20.1492		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Total net area of external elements Aum(A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	58.6289	(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)							11.1506 (36)
Total fabric heat loss						(33) + (36) =	69.7795 (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	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	112.5409	112.2936	112.0511	110.9125	110.6994	109.7077	109.7077	109.5240	110.0897	110.6994	111.1304	111.5810 (39)
Average = Sum(39)m / 12 =												110.9114 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2348	1.2321	1.2294	1.2169	1.2146	1.2037	1.2037	1.2017	1.2079	1.2146	1.2193	1.2243 (40)
HLP (average)												1.2169 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (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)

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 TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9345	19.4820	15.8438	11.9948	8.9663	7.5697	8.1793	10.6318	14.2700	18.1190	21.1475	22.5441	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8678	369.4869	356.5712	335.2575	312.6595	291.6426	278.4728	282.4444	293.8177	315.2729	339.9693	359.4119	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	1.3700	11.2829	0.6300	0.7000	0.7700	4.7241 (75)
Southeast	6.9700	36.7938	0.6300	0.7000	0.7700	78.3754 (77)
Northwest	8.1800	11.2829	0.6300	0.7000	0.7700	28.2064 (81)

Solar gains	111.3058	200.5331	303.4319	424.6653	520.1102	535.9010	508.5291	434.3338	344.9441	229.4655	135.3106	93.9656	(83)
Total gains	482.1736	570.0200	660.0031	759.9228	832.7698	827.5436	787.0019	716.7782	638.7618	544.7383	475.2800	453.3775	(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	56.2388	56.3627	56.4846	57.0645	57.1743	57.6912	57.6912	57.7879	57.4910	57.1743	56.9526	56.7226	
alpha	4.7493	4.7575	4.7656	4.8043	4.8116	4.8461	4.8461	4.8525	4.8327	4.8116	4.7968	4.7815	
util living area	0.9988	0.9972	0.9918	0.9707	0.9028	0.7545	0.5898	0.6597	0.8917	0.9854	0.9976	0.9991	(86)
MIT	19.5815	19.7415	20.0146	20.3847	20.7172	20.9207	20.9811	20.9684	20.8062	20.3742	19.9106	19.5547	(87)
Th 2	19.8923	19.8944	19.8965	19.9065	19.9083	19.9170	19.9170	19.9186	19.9137	19.9083	19.9046	19.9006	(88)
util rest of house	0.9984	0.9962	0.9887	0.9586	0.8619	0.6610	0.4564	0.5251	0.8294	0.9775	0.9965	0.9988	(89)
MIT 2	18.6001	18.7614	19.0346	19.4053	19.7139	19.8800	19.9122	19.9094	19.8012	19.4012	18.9385	18.5799	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.7890	18.9500	19.2232	19.5938	19.9070	20.0803	20.1179	20.1132	19.9947	19.5884	19.1256	18.7675	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7890	18.9500	19.2232	19.5938	19.9070	20.0803	20.1179	20.1132	19.9947	19.5884	19.1256	18.7675	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9978	0.9950	0.9862	0.9542	0.8619	0.6766	0.4824	0.5511	0.8350	0.9743	0.9955	0.9984	(94)
Useful gains	481.1305	567.1431	650.8669	725.1353	717.7453	559.8806	379.6201	395.0170	533.3896	530.7355	473.1251	452.6476	(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	1630.5999	1577.7295	1425.6509	1186.0766	908.5117	601.2259	385.9430	406.6874	648.9410	995.0151	1336.4072	1625.4546	(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	855.2052	679.1141	576.4392	331.8777	141.9302	0.0000	0.0000	0.0000	0.0000	345.4241	621.5632	872.5684	(98)
Space heating												4424.1220	(98)
Space heating per m ²										(98) / (4) =		48.5420	(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	1031.2523	811.8369	832.3827	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8428	0.9077	0.8744	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	869.1571	736.9184	727.8263	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1067.1693	1017.6800	937.3760	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	142.5688	208.8867	155.9049	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												507.3604 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	35.6422	52.2217	38.9762	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												126.8401 (107)
Space cooling per m2												1.3917 (108)
Energy for space heating												48.5420 (99)
Energy for space cooling												1.3917 (108)
Total												49.9338 (109)
Target Fabric Energy Efficiency (TFEE)												57.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.8567			(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) = 17548.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5428 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2013 (36)
Total fabric heat loss (33) + (36) = 77.0581 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	118.8441	118.3427	118.3427	117.6363	117.6363	116.7802	116.9850	116.5814	116.7802	117.1960	117.1960	117.8657 (39)
Average = Sum(39)m / 12 =												117.5155 (39)
HLP	1.3040	1.2985	1.2985	1.2907	1.2907	1.2813	1.2836	1.2791	1.2813	1.2859	1.2859	1.2932 (40)
HLP (average)												1.2894 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

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**Southern Energy
Consultants**
Energy & Sustainability Solutions

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9664	0.9514	0.9132	0.8226	0.6555	0.4031	0.2248	0.2515	0.5698	0.8464	0.9431	0.9711 (94)
Useful gains	712.1417	778.5339	828.7042	841.1170	708.6392	446.7413	235.9415	246.6628	507.4549	664.8778	682.3580	677.5059 (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	1551.1994	1512.6345	1353.0096	1114.3754	794.5822	456.2267	236.6014	247.6723	543.5940	915.6490	1256.6153	1534.2635 (97)
Month fractl	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	624.2589	493.3156	390.0832	196.7460	63.9416	0.0000	0.0000	0.0000	0.0000	186.5737	413.4653	637.5021 (98)
Space heating RHI space heating demand												3005.8865 (98) 3006 (98)



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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	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5813	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8567		(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) = 17548.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5428 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2013 (36)
Total fabric heat loss (33) + (36) = 77.0581 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	121.4035	121.0946	120.7919	119.3701	119.1040	117.8657	117.8657	117.6363	118.3427	119.1040	119.6422	120.2048 (39)
Average = Sum(39)m / 12 =												119.3688 (39)
HLP	1.3321	1.3287	1.3253	1.3097	1.3068	1.2932	1.2932	1.2907	1.2985	1.3068	1.3127	1.3189 (40)
HLP (average)												1.3097 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8362	48.7050	39.6096	29.9870	22.4156	18.9242	20.4483	26.5795	35.6749	45.2975	52.8688	56.3603 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4930	594.8539	571.6872	535.6912	498.7117	465.6568	446.3804	455.0825	475.8332	512.0506	552.3174	582.9020 (73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
Northeast				1.3700	11.2829		0.4400		0.0000		0.7700	5.2370 (75)
Southeast				6.9700	36.7938		0.4400		0.0000		0.7700	86.8863 (77)
Northwest				8.1800	11.2829		0.4400		0.0000		0.7700	31.2694 (81)
Solar gains	123.3927	222.3093	336.3821	470.7804	576.5898	594.0953	563.7511	481.4988	382.4021	254.3835	150.0042	104.1695 (83)
Total gains	722.8857	817.1633	908.0693	1006.4716	1075.3015	1059.7521	1010.1315	936.5813	858.2353	766.4341	702.3216	687.0715 (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	40.1516	40.2540	40.3549	40.8355	40.9268	41.3568	41.3568	41.4374	41.1901	40.9268	40.7427	40.5520
alpha	3.6768	3.6836	3.6903	3.7224	3.7285	3.7571	3.7571	3.7625	3.7460	3.7285	3.7162	3.7035
util living area	0.9854	0.9760	0.9553	0.9034	0.8000	0.6405	0.4921	0.5444	0.7692	0.9290	0.9761	0.9878 (86)
MIT	19.4084	19.6047	19.9286	20.3493	20.6990	20.9077	20.9737	20.9618	20.8094	20.3592	19.8121	19.3728 (87)
Th 2	19.8158	19.8184	19.8210	19.8332	19.8355	19.8461	19.8461	19.8461	19.8420	19.8355	19.8309	19.8261 (88)
util rest of house	0.9816	0.9698	0.9434	0.8769	0.7457	0.5487	0.3726	0.4224	0.6891	0.9037	0.9688	0.9846 (89)
MIT 2	17.7347	18.0197	18.4854	19.0807	19.5376	19.7802	19.8350	19.8301	19.6848	19.1095	18.3309	17.6897 (90)
Living area fraction									FLA = Living area / (4) =			0.1925 (91)
MIT	18.0568	18.3247	18.7632	19.3249	19.7611	19.9972	20.0541	20.0479	19.9012	19.3500	18.6160	18.0136 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9068	18.1747	18.6132	19.1749	19.6111	19.8472	19.9041	19.8979	19.7512	19.2000	18.4660	17.8636 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9725	0.9575	0.9270	0.8584	0.7336	0.5488	0.3789	0.4280	0.6819	0.8856	0.9566	0.9765 (94)
Useful gains	702.9948	782.4711	841.7464	863.9556	788.8612	581.5733	382.7054	400.8200	585.1938	678.7416	671.8236	670.9562 (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	1651.9109	1607.4985	1463.1735	1226.5139	942.2457	618.4678	389.4418	411.4819	668.7763	1024.2993	1359.8538	1642.4333 (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	705.9936	554.4184	462.3418	261.0419	114.1180	0.0000	0.0000	0.0000	0.0000	257.0949	495.3817	722.7789 (98)
Space heating												3573.1693 (98)
Space heating per m2										(98) / (4) =		39.2053 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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												3948.2534 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	705.9936	554.4184	462.3418	261.0419	114.1180	0.0000	0.0000	0.0000	0.0000	257.0949	495.3817	722.7789 (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)	780.1034	612.6170	510.8749	288.4441	126.0973	0.0000	0.0000	0.0000	0.0000	284.0828	547.3831	798.6508 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Efficiency of water heater (217)m	89.8540	89.7953	89.6676	89.3671	88.7468	87.3000	87.3000	87.3000	87.3000	89.3285	89.7176	87.3000 (216)
Fuel for water heating, kWh/month	191.6940	168.2050	174.8577	154.4213	150.3013	133.4888	125.3239	141.4982	142.5034	160.3480	172.3787	186.0729 (219)
Water heating fuel used												1901.0934 (219)
Annual totals kWh/year												
Space heating fuel - main system												3948.2534 (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)												387.3697 (232)
Total delivered energy for all uses												6311.7165 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3948.2534	3.4800	137.3992 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1901.0934	3.4800	66.1581 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.3697	13.1900	51.0941 (250)
Additional standing charges			120.0000 (251)
Total energy cost			384.5438 (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] =	1.1863 (257)
SAP value		83.4505
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	3948.2534	0.2160	852.8227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1901.0934	0.2160	410.6362 (264)
Space and water heating			1263.4589 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.3697	0.5190	201.0449 (268)
Total kg/year			1503.4288 (272)
CO2 emissions per m2			16.5000 (273)
EI value			85.2020
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	$3.48 / 0.8880 = 3.919$, stars = 4
Water heating environmental impact	$0.216 / 0.8880 = 0.2433$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =		0.3667 (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												
Effective ac	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.8567		(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) = 17548.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5428 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2013 (36)
Total fabric heat loss (33) + (36) = 77.0581 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	118.8441	118.3427	118.3427	117.6363	117.6363	116.7802	116.9850	116.5814	116.7802	117.1960	117.1960	117.8657 (39)
Average = Sum(39)m / 12 =												117.5155 (39)
HLP	1.3040	1.2985	1.2985	1.2907	1.2907	1.2813	1.2836	1.2791	1.2813	1.2859	1.2859	1.2932 (40)
HLP (average)												1.2894 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8362	48.7050	39.6096	29.9870	22.4156	18.9242	20.4483	26.5795	35.6749	45.2975	52.8688	56.3603 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4930	594.8539	571.6872	535.6912	498.7117	465.6568	446.3804	455.0825	475.8332	512.0506	552.3174	582.9020 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast				1.3700	12.9236	0.4400	0.0000			0.7700			5.9985 (75)
Southeast				6.9700	40.4699	0.4400	0.0000			0.7700			95.5671 (77)
Northwest				8.1800	12.9236	0.4400	0.0000			0.7700			35.8161 (81)
Solar gains	137.3818	223.4350	335.7716	486.8390	582.3829	642.5393	603.0068	525.8301	414.7054	273.5110	171.2424	114.7719	(83)
Total gains	736.8748	818.2889	907.4589	1022.5302	1081.0946	1108.1961	1049.3871	980.9126	890.5386	785.5616	723.5598	697.6739	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.0163	41.1901	41.1901	41.4374	41.4374	41.7412	41.6681	41.8123	41.7412	41.5931	41.5931	41.3568
alpha	3.7344	3.7460	3.7460	3.7625	3.7625	3.7827	3.7779	3.7875	3.7827	3.7729	3.7729	3.7571
util living area	0.9817	0.9719	0.9454	0.8743	0.7321	0.5037	0.3415	0.3742	0.6720	0.9000	0.9674	0.9845 (86)
MIT	19.5801	19.7479	20.0839	20.4973	20.8173	20.9686	20.9947	20.9927	20.9035	20.5176	19.9934	19.5512 (87)
Th 2	19.8377	19.8420	19.8420	19.8481	19.8481	19.8555	19.8537	19.8572	19.8555	19.8519	19.8519	19.8461 (88)
util rest of house	0.9768	0.9645	0.9304	0.8398	0.6618	0.3982	0.2173	0.2436	0.5699	0.8639	0.9572	0.9803 (89)
MIT 2	17.9979	18.2420	18.7206	19.2909	19.6870	19.8394	19.8527	19.8556	19.7907	19.3355	18.6052	17.9621 (90)
Living area fraction									FLA = Living area / (4) =			0.1925 (91)
MIT	18.3024	18.5318	18.9830	19.5231	19.9046	20.0567	20.0725	20.0745	20.0048	19.5630	18.8723	18.2679 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1524	18.3818	18.8330	19.3731	19.7546	19.9067	19.9225	19.9245	19.8548	19.4130	18.7223	18.1179 (93)

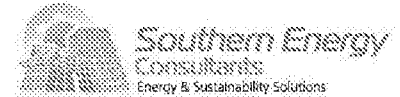
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9664	0.9514	0.9132	0.8226	0.6555	0.4031	0.2248	0.2515	0.5698	0.8464	0.9431	0.9711 (94)
Ext temp.	712.1417	778.5339	828.7042	841.1170	708.6392	446.7413	235.9415	246.6628	507.4549	664.8778	682.3580	677.5059 (95)
Heat loss rate W	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)
Month fracti	1551.1994	1512.6345	1353.0096	1114.3754	794.5822	456.2267	236.6014	247.6723	543.5940	915.6490	1256.6153	1534.3635 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	624.2589	493.3156	390.0832	196.7460	63.9416	0.0000	0.0000	0.0000	0.0000	186.5737	413.4653	637.5021 (98)
Space heating per m2												3005.8865 (98)
										(98) / (4) =		32.9810 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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													3321.4215 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	624.2589	493.3156	390.0832	196.7460	63.9416	0.0000	0.0000	0.0000	0.0000	186.5737	413.4653	637.5021	(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)	689.7889	545.1001	431.0312	217.3989	70.6537	0.0000	0.0000	0.0000	0.0000	206.1588	456.8677	704.4222	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)
Efficiency of water heater (217)m	89.7883	89.7290	89.5588	89.1528	88.3118	87.3000	87.3000	87.3000	87.3000	89.0819	89.6059	89.8158	(216)
Fuel for water heating, kWh/month	191.8345	168.3292	175.0702	154.7926	151.0416	133.4888	125.3239	141.4982	142.5034	160.7919	172.5936	186.2078	(219)
Water heating fuel used												1903.4758	(219)
Annual totals kWh/year													
Space heating fuel - main system													3321.4215 (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)													387.3697 (232)
Total delivered energy for all uses													5687.2670 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3321.4215	3.8700	128.5390 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1903.4758	3.8700	73.6645 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	387.3697	18.9000	73.2129 (250)
Additional standing charges			93.0000 (251)
Total energy cost			382.5914 (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	3321.4215	0.2160	717.4270 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.4758	0.2160	411.1508 (264)
Space and water heating			1128.5778 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.3697	0.5190	201.0449 (268)
Total kg/year			1368.5477 (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	3321.4215	1.2200	4052.1343 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.4758	1.2200	2322.2404 (264)
Space and water heating			6374.3747 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	387.3697	3.0700	1189.2250 (268)
Primary energy kWh/year			7793.8497 (272)
Primary energy kWh/m2/year			85.5151 (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 (13.6%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (80.1%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£29	2.05 kg/m²	B 85	B 87
Solar photovoltaic panels	£345	10.39 kg/m²	A 94	A 96
Total Savings	£373	12.44 kg/m²		

Potential energy efficiency rating: A 94
 Potential environmental impact rating: A 96

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	£87	£97	-£9
Mains gas	£295	£257	£38
Space heating	£236	£236	£0
Water heating	£74	£45	£29
Lighting	£73	£73	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£382	£9	£374
Total cost of uses	£383	£9	£374
Delivered energy	62 kWh/m²	32 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	12 kg/m²
Primary energy	86 kWh/m²	13 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	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =		0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5813	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8567		(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) = 17548.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5428 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2013 (36)
Total fabric heat loss (33) + (36) = 77.0581 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	121.4035	121.0946	120.7919	119.3701	119.1040	117.8657	117.8657	117.6363	118.3427	119.1040	119.6422	120.2048 (39)
Average = Sum(39)m / 12 =												119.3688 (39)
HLP	1.3321	1.3287	1.3253	1.3097	1.3068	1.2932	1.2932	1.2907	1.2985	1.3068	1.3127	1.3189 (40)
HLP (average)												1.3097 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1893 (H8)
Utilisation factor												0.5687 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input	-24.9478	-41.6307	-70.9019	-95.0225	-117.3923	-115.4153	-113.8901	-99.5063	-77.9334	-53.2193	-29.5917	-860.3285 (H17)
Solar input (sum of months) = Sum(63)m =												-860.3285 (63)
Output from w/h	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669 (64)
Total per year (kWh/year) = Sum(64)m =												834.6306 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8362	48.7050	39.6096	29.9870	22.4156	18.9242	20.4483	26.5795	35.6749	45.2975	52.8688	56.3603	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4930	594.8539	571.6872	535.6912	498.7117	465.6568	446.3804	455.0825	475.8332	512.0506	552.3174	582.9020	(73)

6. Solar gains

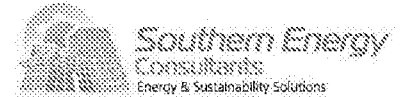
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				1.3700	11.2829		0.4400	0.0000	0.7700		5.2370 (75)	
Southeast				6.9700	36.7938		0.4400	0.0000	0.7700		86.8863 (77)	
Northwest				8.1800	11.2829		0.4400	0.0000	0.7700		31.2694 (81)	
Solar gains	123.3927	222.3093	336.3821	470.7804	576.5898	594.0953	563.7511	481.4988	382.4021	254.3835	150.0042	104.1695 (83)
Total gains	722.8857	817.1633	908.0693	1006.4716	1075.3015	1059.7521	1010.1315	936.5813	858.2353	766.4341	702.3216	687.0715 (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	40.1516	40.2540	40.3549	40.8355	40.9268	41.3568	41.3568	41.4374	41.1901	40.9268	40.7427	40.5520	
alpha	3.6768	3.6836	3.6903	3.7224	3.7285	3.7571	3.7571	3.7625	3.7460	3.7285	3.7162	3.7035	
util living area	0.9854	0.9760	0.9553	0.9034	0.8000	0.6405	0.4921	0.5444	0.7692	0.9290	0.9761	0.9878	(86)
MIT	19.4084	19.6047	19.9286	20.3493	20.6990	20.9077	20.9737	20.9618	20.8094	20.3592	19.8121	19.3728	(87)
Th 2	19.8158	19.8184	19.8210	19.8332	19.8355	19.8461	19.8461	19.8481	19.8420	19.8355	19.8309	19.8261	(88)
util rest of house	0.9816	0.9698	0.9434	0.8769	0.7457	0.5487	0.3726	0.4224	0.6891	0.9037	0.9688	0.9846	(89)
MIT 2	17.7347	18.0197	18.4854	19.0807	19.5376	19.7802	19.8350	19.8301	19.6848	19.1095	18.3309	17.6897	(90)
Living area fraction													(91)
MIT	18.0568	18.3247	18.7632	19.3249	19.7611	19.9972	20.0541	20.0479	19.9012	19.3500	18.6160	18.0136	(92)
Temperature adjustment													(93)
adjusted MIT	17.9068	18.1747	18.6132	19.1749	19.6111	19.8472	19.9041	19.8979	19.7512	19.2000	18.4660	17.8636	(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	0.9725	0.9575	0.9270	0.8584	0.7336	0.5488	0.3789	0.4280	0.6819	0.8856	0.9566	0.9765	(94)
Useful gains	702.9948	782.4711	841.7464	863.9556	788.8612	581.5733	382.7054	400.8200	585.1938	678.7416	671.8236	670.9562	(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	1651.9109	1607.4985	1463.1735	1226.5139	942.2457	618.4678	389.4418	411.4819	668.7763	1024.2993	1359.8538	1642.4333	(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	705.9936	554.4184	462.3418	261.0419	114.1180	0.0000	0.0000	0.0000	0.0000	257.0949	495.3817	722.7789	(98)
Space heating												3573.1693	(98)
Space heating per m2											(98) / (4) =	39.2053	(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													3948.2534 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	705.9936	554.4184	462.3418	261.0419	114.1180	0.0000	0.0000	0.0000	0.0000	257.0949	495.3817	722.7789	(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)	780.1034	612.6170	510.8749	288.4441	126.0973	0.0000	0.0000	0.0000	0.0000	284.0828	547.3831	798.6508	(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	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669	(64)
Efficiency of water heater	89.9310	89.9565	89.9833	90.0335	90.0940	87.3000	87.3000	87.3000	87.3000	89.6478	89.8362	89.9448	(216)
Fuel for water heating, kWh/month	163.7890	121.6248	95.4499	47.7372	17.7541	1.2834	0.0000	27.5162	53.2326	100.4119	139.2115	162.7298	(219)
Water heating fuel used												930.7402	(219)
Annual totals kWh/year													
Space heating fuel - main system												3948.2534	(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)												387.3697	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												3664.1239	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3948.2534	3.4800	137.3992	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	930.7402	3.4800	32.3898	(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	387.3697	13.1900	51.0941	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			129.5477	(255)

11a. SAP rating - Individual heating systems

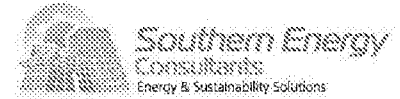
Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.3997 (257)
SAP value			94.4247
SAP rating (Section 12)			94 (258)
SAP band			A

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

Energy Emission factor Emissions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3948.2534	0.2160	852.8227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	930.7402	0.2160	201.0399 (264)
Space and water heating			1053.8626 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	387.3697	0.5190	201.0449 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			423.3452 (272)
CO2 emissions per m2			4.6400 (273)
EI value			95.8331
EI rating			96 (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	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =		0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (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)			16.5200	1.2357	20.4144		(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)
Clad Cavity	132.7600	20.8200	111.9400	0.2400	26.8656	60.0000	6716.4000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8567		(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) = 17548.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5428 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2013 (36)
 Total fabric heat loss (33) + (36) = 77.0581 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	118.8441	118.3427	118.3427	117.6363	117.6363	116.7802	116.9850	116.5814	116.7802	117.1960	117.1960	117.8657 (39)
Average = Sum(39)m / 12 =												117.5155 (39)
HLP	1.3040	1.2985	1.2985	1.2907	1.2907	1.2813	1.2836	1.2791	1.2813	1.2859	1.2859	1.2932 (40)
HLP (average)												1.2894 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2560 (H8)
Utilisation factor												0.5490 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-877.1154 (H17)
Solar input	-26.9972	-40.5767	-68.3363	-94.4617	-113.7636	-119.7313	-116.8563	-104.3534	-81.4482	-55.4077	-32.8158	-877.1154 (63)
Solar input (sum of months) = Sum(63)m =												-877.1154 (63)
Output from w/h	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767 (64)
Total per year (kWh/year) = Sum(64)m =												824.0055 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8362	48.7050	39.6096	29.9870	22.4156	18.9242	20.4483	26.5795	35.6749	45.2975	52.8688	56.3603	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4930	594.8539	571.6872	535.6912	498.7117	465.6568	446.3804	455.0825	475.8332	512.0506	552.3174	582.9020	(73)

6. Solar gains

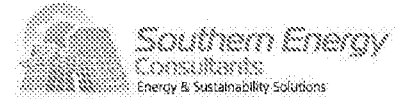
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				1.3700	12.9236	0.4400	0.0000	0.7700	5.9985 (75)				
Southeast				6.9700	40.4699	0.4400	0.0000	0.7700	95.5671 (77)				
Northwest				8.1800	12.9236	0.4400	0.0000	0.7700	35.8161 (81)				
Solar gains	137.3818	223.4350	335.7716	486.8390	582.3829	642.5393	603.0068	525.8301	414.7054	273.5110	171.2424	114.7719	(83)
Total gains	736.8748	818.2889	907.4589	1022.5302	1081.0946	1108.1961	1049.3871	980.9126	890.5386	785.5616	723.5598	697.6739	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.0163	41.1901	41.1901	41.4374	41.4374	41.7412	41.6681	41.8123	41.7412	41.5931	41.5931	41.3568	
alpha	3.7344	3.7460	3.7460	3.7625	3.7625	3.7827	3.7779	3.7875	3.7827	3.7729	3.7729	3.7571	
util living area	0.9817	0.9719	0.9454	0.8743	0.7321	0.5037	0.3415	0.3742	0.6720	0.9000	0.9674	0.9845	(86)
MIT	19.5801	19.7479	20.0839	20.4973	20.8173	20.9686	20.9947	20.9927	20.9035	20.5176	19.9934	19.5512	(87)
Th 2	19.8377	19.8420	19.8420	19.8481	19.8481	19.8555	19.8537	19.8572	19.8555	19.8519	19.8519	19.8461	(88)
util rest of house	0.9768	0.9645	0.9304	0.8398	0.6618	0.3982	0.2173	0.2436	0.5699	0.8639	0.9572	0.9803	(89)
MIT 2	17.9979	18.2420	18.7206	19.2909	19.6870	19.8394	19.8527	19.8556	19.7907	19.3355	18.6052	17.9621	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.3024	18.5318	18.9830	19.5231	19.9046	20.0567	20.0725	20.0745	20.0048	19.5630	18.8723	18.2679	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1524	18.3818	18.8330	19.3731	19.7546	19.9067	19.9225	19.9245	19.8548	19.4130	18.7223	18.1179	(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	0.9664	0.9514	0.9132	0.8226	0.6555	0.4031	0.2248	0.2515	0.5698	0.8464	0.9431	0.9711	(94)
Useful gains	712.1417	778.5339	828.7042	841.1170	708.6392	446.7413	235.9415	246.6628	507.4549	664.8778	682.3580	677.5059	(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	1551.1994	1512.6345	1353.0096	1114.3754	794.5822	456.2267	236.6014	247.6723	543.5940	915.6490	1256.6153	1534.3635	(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	624.2589	493.3156	390.0832	196.7460	63.9416	0.0000	0.0000	0.0000	0.0000	186.5737	413.4653	637.5021	(98)
Space heating												3005.8865	(98)
Space heating per m2											(98) / (4) =	32.9810	(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													3321.4215 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	624.2589	493.3156	390.0832	196.7460	63.9416	0.0000	0.0000	0.0000	0.0000	186.5737	413.4653	637.5021	(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)	689.7889	545.1001	431.0312	217.3989	70.6537	0.0000	0.0000	0.0000	0.0000	206.1588	456.8677	704.4222	(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	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767	(64)
Efficiency of water heater	89.8781	89.8971	89.8909	89.9029	89.7276	87.3000	87.3000	87.3000	87.3000	89.4505	89.7512	89.8899	(216)
(217)m	89.8781	89.8971	89.8909	89.9029	89.7276	87.3000	87.3000	87.3000	87.3000	89.4505	89.7512	89.8899	(217)
Fuel for water heating, kWh/month	161.6051	122.8776	98.4020	48.4303	21.8707	0.0000	0.0000	21.9640	49.2066	98.1869	135.7511	161.1713	(219)
Water heating fuel used												919.4656	(219)
Annual totals kWh/year													
Space heating fuel - main system												3321.4215	(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)												387.3697	(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												2929.0972	(238)

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

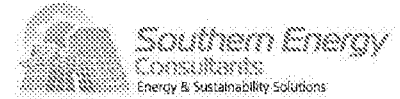
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3321.4215	3.8700	128.5390	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	919.4656	3.8700	35.5833	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	387.3697	18.9000	73.2129	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			9.1940	(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	3321.4215	0.2160	717.4270	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	919.4656	0.2160	198.6046	(264)
Space and water heating			916.0316	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	387.3697	0.5190	201.0449	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			235.2126	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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	3321.4215	1.2200	4052.1343 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.4656	1.2200	1121.7480 (264)
Space and water heating			5173.8823 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	387.3697	3.0700	1189.2250 (268)
Energy saving/generation technologies			
FV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1146.6872 (272)
Primary energy kWh/m2/year			12.5816 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	192.5 (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	291.14 (P1)
Transmission heat loss coefficient	77.06 (37)
Summer heat loss coefficient	368.20 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	1.3700	98.8453	0.4400	0.0000	0.9000	53.6255
South East	6.9700	119.9223	0.4400	0.0000	0.9000	331.0001
North West	8.1800	98.8453	0.4400	0.0000	0.9000	320.1875

total: 704.8131

	Jun	Jul	Aug	
Solar gains	751	705	615	(P4)
Internal gains	463	443	452	
Total summer gains	1214	1148	1067	(P5)

Summer gain/loss ratio	3.30	3.12	2.90	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 192.5)	0.65	0.65	0.65	
Threshold temperature	19.95	21.67	21.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight