

FULL SAP CALCULATION PRINTOUT

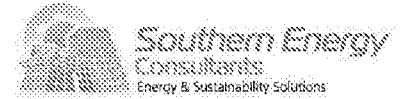
Calculation Type: New Build (As Designed)



Property Reference	SECANG007e			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Mid Bri Ea		
Property	2B3P, Plot 30,33,60				
SAP Rating	84 B	DER	17.44	TSL	18.14
Environmental	87 B	% DER<TER	3.86		
CO ₂ Emissions (t/year)	1.02	DPEE	43.11	TPEE	46.26
General Requirements Compliance	Pass	% DPEE<TPEE	6.82		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Mid-Terrace House, total floor area 73 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) 18.14 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)46.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (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:

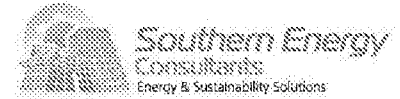
Overshading: Average
Windows facing East: 3.24 m², No overhang
Windows facing West: 3.58 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17941.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.9650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss							(33) + (36) = 42.1438 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	78.4954	78.2594	78.0279	76.9410	76.7377	75.7910	75.7910	75.6157	76.1556	76.7377	77.1491	77.5792 (39)
Average = Sum(39)m / 12 =												76.9401 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0718	1.0685	1.0654	1.0505	1.0478	1.0348	1.0348	1.0324	1.0398	1.0478	1.0534	1.0592 (40)
HLP (average)												1.0505 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1405.8389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083 (61)
Total heat required for water heating calculated for each month											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)
Heat gains from water heating, kWh/month											
51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (65)
Total per year (kWh/year) = Sum(64)m =	1570.8557 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3899	18.9983	15.4505	11.6970	8.7436	7.3817	7.9762	10.3678	13.9157	17.6691	20.6225	21.9844	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	356.8373	354.4986	341.2998	320.3089	299.1760	278.9544	265.9812	272.0606	283.0295	304.2244	328.3902	346.3392	(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
East			3.2400			19.6403	0.4400	0.0000			0.7700	21.5594 (76)
West			3.5800			19.6403	0.4400	0.0000			0.7700	23.8218 (80)

Solar gains	45.3811	88.7751	146.1999	213.2238	261.3138	267.5012	254.6720	218.7595	170.0365	105.3391	56.5849	37.3192 (83)
Total gains	402.2185	443.2737	487.4997	533.5327	560.4898	546.4556	520.6532	490.8201	453.0660	409.5636	384.9752	383.6585 (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	63.4900	63.6816	63.8704	64.7727	64.9443	65.7555	65.7555	65.9080	65.4407	64.9443	64.5980	64.2399
alpha	5.2327	5.2454	5.2580	5.3182	5.3296	5.3837	5.3837	5.3939	5.3627	5.3296	5.3065	5.2827
util living area	0.9986	0.9973	0.9932	0.9772	0.9244	0.7891	0.6183	0.6724	0.8981	0.9859	0.9972	0.9989 (86)
MIT	19.7978	19.9179	20.1432	20.4562	20.7403	20.9283	20.9846	20.9763	20.8423	20.4763	20.0865	19.7806 (87)
Th 2	20.0240	20.0266	20.0292	20.0414	20.0437	20.0544	20.0544	20.0564	20.0503	20.0437	20.0391	20.0343 (88)
util rest of house	0.9981	0.9964	0.9907	0.9681	0.8923	0.7072	0.4966	0.5519	0.8429	0.9787	0.9961	0.9985 (89)
MIT 2	18.4112	18.5886	18.9188	19.3789	19.7711	20.0019	20.0481	20.0455	19.9115	19.4137	18.8444	18.3934 (90)
Living area fraction	18.6611	18.8282	19.1395	19.5731	19.9458	20.1688	20.2169	20.2132	20.0792	19.6052	19.0683	18.6434 (92)
MIT	18.5111	18.6782	18.9895	19.4231	19.7958	20.0188	20.0669	20.0632	19.9292	19.4552	18.9183	18.4934 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.4934 (93)

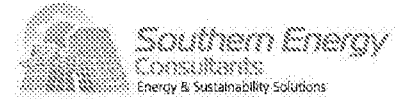
8. Space heating requirement

Utilisation	0.9969	0.9944	0.9867	0.9600	0.8820	0.7037	0.4983	0.5528	0.8341	0.9721	0.9940	0.9976 (94)
Useful gains	400.9800	440.7998	481.0321	512.2053	494.3271	384.5477	259.4368	271.3365	377.9127	398.1480	382.6735	382.7357 (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	1115.5063	1078.2693	974.5280	809.6588	621.2510	410.6986	262.7562	276.9971	443.9287	679.5281	911.7701	1108.8709 (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	531.6076	428.3795	367.1610	214.1665	94.4313	0.0000	0.0000	0.0000	0.0000	209.3468	380.9496	540.2447 (98)
Space heating												2766.2869 (98)
Space heating per m ²												(98) / (4) = 37.7702 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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													3056.6706 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	531.6076	428.3795	367.1610	214.1665	94.4313	0.0000	0.0000	0.0000	0.0000	209.3468	380.9496	540.2447	(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)	587.4117	473.3475	405.7027	236.6481	104.3440	0.0000	0.0000	0.0000	0.0000	231.3225	420.9387	596.9554	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)
Efficiency of water heater (217)m	89.7395	89.6894	89.5678	89.2744	88.6551	87.3000	87.3000	87.3000	87.3000	89.2288	89.6009	87.3000	(216)
Fuel for water heating, kWh/month	178.1331	156.3102	162.5482	143.6461	139.8925	124.2327	116.7468	131.6541	132.5400	149.1646	160.2598	172.9460	(219)
Water heating fuel used													1768.0741 (219)
Annual totals kWh/year													
Space heating fuel - main system													3056.6706 (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)													377.7519 (232)
Total delivered energy for all uses													5277.4966 (238)

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

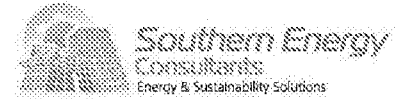
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3056.6706	0.2160	660.2409 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1768.0741	0.2160	381.9040 (264)
Space and water heating			1042.1449 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.7519	0.5190	196.0533 (268)
Total CO2, kg/year			1277.1231 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4400 (273)

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

DER			17.4400 ZC1
Total Floor Area		TFA	73.2400
Assumed number of occupants		N	2.3221
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.5652 ZC2
CO2 emissions from cooking, equation (L16)			2.3857 ZC3
Total CO2 emissions			36.3909 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			36.3909 ZC8

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4130 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	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)			6.8200	1.3258	9.0417			(27)				
Heat Loss Floor 1			36.6200	0.1300	4.7606			(28a)				
Brick Cavity	45.4900	11.1200	34.3700	0.1800	6.1866			(29a)				
External Roof 1	36.6200		36.6200	0.1300	4.7606			(30)				
Total net area of external elements Aum(A, m2)			118.7300					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4795			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								8.2145 (36)				
Total fabric heat loss						(33) + (36) =		37.6940 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.3517	Feb 36.1156	Mar 35.8842	Apr 34.7973	May 34.5939	Jun 33.6472	Jul 33.6472	Aug 33.4719	Sep 34.0119	Oct 34.5939	Nov 35.0053	Dec 35.4354 (38)
Heat transfer coeff	74.0457	73.8096	73.5782	72.4912	72.2879	71.3412	71.3412	71.1659	71.7058	72.2879	72.6993	73.1294 (39)
Average = Sum(39)m / 12 =												72.4903 (39)
HLP	Jan 1.0110	Feb 1.0078	Mar 1.0046	Apr 0.9898	May 0.9870	Jun 0.9741	Jul 0.9741	Aug 0.9717	Sep 0.9791	Oct 0.9870	Nov 0.9926	Dec 0.9985 (40)
HLP (average)												0.9898 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)
Energy content (annual)										Total = Sum(45)m =		1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.0855	43.5935	46.4429	43.1822	42.8003	39.6571	40.9791	42.8003	43.1822	46.4429	46.7073	50.0855			(61)
Total heat required for water heating calculated for each month	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419			(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	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419			(64)
Heat gains from water heating, kWh/month	60.9851	53.2850	55.3499	48.9285	47.2895	41.4882	39.5026	44.2739	44.7704	51.2051	54.8972	59.4559			(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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073			(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3899	18.9983	15.4505	11.6970	8.7436	7.3817	7.9762	10.3678	13.9157	17.6691	20.6225	21.9844			(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043			(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107			(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859			(71)
Water heating gains (Table 5)	81.9692	79.2932	74.3951	67.9562	63.5612	57.6225	53.0949	59.5079	62.1811	68.8240	76.2461	79.9138			(72)
Total internal gains	368.9291	365.9861	352.1864	330.5965	308.8608	288.0381	275.0715	281.7515	293.3263	315.1202	339.8830	358.4347			(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	
East					3.2400	19.6403	0.6300	0.7000	0.7700		19.4475	
West					3.5800	19.6403	0.6300	0.7000	0.7700		21.4883 (80)	

Solar gains	40.9358	80.0792	131.8790	192.3376	235.7169	241.2982	229.7258	197.3310	153.3807	95.0207	51.0422	33.6636 (83)
Total gains	409.8649	446.0653	484.0654	522.9341	544.5777	529.3364	504.7972	479.0826	446.7069	410.1409	390.9251	392.0983 (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	68.6889	68.9086	69.1253	70.1617	70.3591	71.2928	71.2928	71.4684	70.9302	70.3591	69.9610	69.5495				
alpha	5.5793	5.5939	5.6084	5.6774	5.6906	5.7529	5.7529	5.7646	5.7287	5.6906	5.6641	5.6366				
util living area	0.9986	0.9974	0.9935	0.9779	0.9242	0.7824	0.6059	0.6572	0.8912	0.9853	0.9972	0.9989				(86)
MIT	19.9116	20.0213	20.2282	20.5169	20.7767	20.9438	20.9893	20.9834	20.8721	20.5405	20.1806	19.8964				(87)
Th 2	20.0742	20.0769	20.0795	20.0919	20.0942	20.1050	20.1050	20.1070	20.1008	20.0942	20.0895	20.0846				(88)
util rest of house	0.9981	0.9965	0.9911	0.9690	0.8924	0.7023	0.4909	0.5426	0.8350	0.9778	0.9960	0.9985				(89)
MIT 2	18.6118	18.7741	19.0774	19.5026	19.8604	20.0643	20.1007	20.0995	19.9898	19.5420	19.0165	18.5972				(90)
Living area fraction	18.8461	18.9989	19.2848	19.6854	20.0255	20.2228	20.2608	20.2588	20.1488	19.7220	19.2263	18.8313				(91)
MIT	18.8461	18.9989	19.2848	19.6854	20.0255	20.2228	20.2608	20.2588	20.1488	19.7220	19.2263	18.8313				(92)
Temperature adjustment												0.0000				
adjusted MIT	18.8461	18.9989	19.2848	19.6854	20.0255	20.2228	20.2608	20.2588	20.1488	19.7220	19.2263	18.8313				(93)

8. Space heating requirement

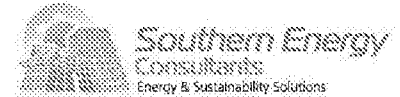
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Useful gains	408.7053	443.8268	478.3348	503.9916	484.4363	377.8515	258.2888	269.7630	374.5857	399.2910	388.7414	391.2308			(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000			(96)
Heat loss rate W	1077.0739	1040.6317	940.6843	781.8464	601.8346	401.1350	261.1674	274.6149	433.7322	659.4072	881.5706	1069.9813			(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	497.2662	401.0529	343.9880	200.0555	87.3443	0.0000	0.0000	0.0000	0.0000	193.5264	354.8370	504.9904			(98)
Space heating												2583.0607			(98)
Space heating per m ²												35.2684			(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Target Emissions 09 Jan 2014

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

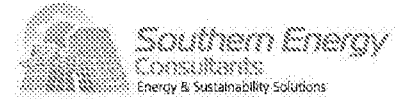
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2765.5897 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	497.2662	401.0529	343.9880	200.0555	87.3443	0.0000	0.0000	0.0000	0.0000	193.5264	354.8370	504.9904	(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)	532.4049	429.3928	368.2955	214.1922	93.5164	0.0000	0.0000	0.0000	0.0000	207.2018	379.9111	540.6749	(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	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419	(64)
Efficiency of water heater (217)m	87.2975	87.1234	86.6823	85.6485	83.7007	80.3000	80.3000	80.3000	80.3000	85.4455	86.7719	87.3811	(216)
Fuel for water heating, kWh/month	224.3374	196.3562	205.3355	184.3204	182.6076	167.6417	160.6135	179.0464	181.0238	193.7184	203.6296	218.8596	(219)
Water heating fuel used												2297.4898	(219)
Annual totals kWh/year													
Space heating fuel - main system												2765.5897	(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)												377.7519	(232)
Total delivered energy for all uses												5515.8314	(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	2765.5897	0.2160	597.3674 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2297.4898	0.2160	496.2578 (264)
Space and water heating			1093.6252 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.7519	0.5190	196.0533 (268)
Total CO2, kg/m2/year			1328.6034 (272)
Emissions per m2 for space and water heating			14.9321 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6769 (272b)
Emissions per m2 for pumps and fans			0.5315 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9321 * 1.00) + 2.6769 + 0.5315, rounded to 2 d.p.			18.1400 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =				0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			9.0000	329.5800 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			17611.6600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							240.4650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss				(33) + (36) =			42.1438 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	78.4954	78.2594	78.0279	76.9410	76.7377	75.7910	75.7910	75.6157	76.1556	76.7377	77.1491	77.5792 (39)
Average = Sum(39)m / 12 =												76.9401 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0718	1.0685	1.0654	1.0505	1.0478	1.0348	1.0348	1.0324	1.0398	1.0478	1.0534	1.0592 (40)
HLP (average)												1.0505 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1405.8389 (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 (46)
Water storage loss:											
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	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	30.9730	27.0892	27.9536	24.3707	23.3842	20.1788	18.6986	21.4570	21.7132	25.3047	29.9957 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3899	18.9983	15.4505	11.6970	8.7436	7.3817	7.9762	10.3678	13.9157	17.6691	20.6225	21.9844	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	41.6304	40.3113	37.5721	33.8481	31.4304	28.0261	25.1326	28.8400	30.1572	34.0116	38.3639	40.3168	(72)
Total internal gains	325.5904	324.0042	312.3634	293.4884	273.7300	255.4418	244.1091	248.0836	258.3025	277.3079	299.0008	315.8377	(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
East					3.2400	19.6403	0.4400	0.0000			0.7700			21.5594 (76)
West					3.5800	19.6403	0.4400	0.0000			0.7700			23.8218 (80)
Solar gains	45.3811	88.7751	146.1999	213.2238	261.3138	267.5012	254.6720	218.7595	170.0365	105.3391	56.5849			37.3192 (83)
Total gains	370.9715	412.7793	458.5633	506.7123	535.0438	522.9430	498.7812	466.8431	428.3390	382.6470	355.5857	353.1569	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3237	62.5117	62.6971	63.5828	63.7513	64.5476	64.5476	64.6973	64.2386	63.7513	63.4114	63.0598	
alpha	5.1549	5.1674	5.1798	5.2389	5.2501	5.3032	5.3032	5.3132	5.2826	5.2501	5.2274	5.2040	
util living area	0.9989	0.9979	0.9944	0.9807	0.9339	0.8081	0.6401	0.6979	0.9132	0.9889	0.9979	0.9992	(86)
MIT	19.7382	19.8613	20.0926	20.4152	20.7116	20.9156	20.9808	20.9703	20.8186	20.4343	20.0338	19.7215	(87)
Th 2	20.0240	20.0266	20.0292	20.0414	20.0437	20.0544	20.0544	20.0564	20.0503	20.0437	20.0391	20.0343	(88)
util rest of house	0.9986	0.9972	0.9924	0.9730	0.9051	0.7289	0.5166	0.5767	0.8635	0.9832	0.9971	0.9989	(89)
MIT 2	18.8648	18.9898	19.2223	19.5507	19.8334	20.0109	20.0488	20.0466	19.9379	19.5740	19.1723	18.8564	(90)
Living area fraction	fLA = Living area / (4) =											0.1802	(91)
MIT	19.0222	19.1469	19.3792	19.7065	19.9917	20.1739	20.2168	20.2131	20.0966	19.7290	19.3276	19.0124	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0222	19.1469	19.3792	19.7065	19.9917	20.1739	20.2168	20.2131	20.0966	19.7290	19.3276	19.0124	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9981	0.9963	0.9906	0.9694	0.9032	0.7401	0.5390	0.5984	0.8665	0.9806	0.9962	0.9985	(94)
Ext temp.	370.2508	411.2450	454.2461	491.2271	483.2284	387.0497	268.8351	279.3814	371.1494	375.2198	354.2322	352.6294	(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	1155.6282	1114.9504	1004.9364	831.4642	636.2826	422.4533	274.1194	288.3283	456.6755	700.5389	943.3445	1149.1302	(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	584.3208	472.8900	409.7136	244.9707	113.8724	0.0000	0.0000	0.0000	0.0000	242.0374	424.1608	592.5966	(98)
Space heating												3084.5624	(98)
Space heating per m2												42.1158	(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	712.4353	560.8533	574.6792	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8332	0.9054	0.8796	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

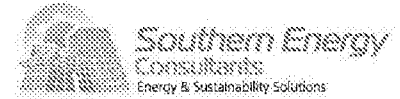


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	593.5955	507.8169	505.5098	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	698.9343	669.0489	633.5886	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	75.8439	119.9566	95.2907	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			291.0911 (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	18.9610	29.9891	23.8227	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												72.7728 (107)
Energy for space heating												0.9936 (108)
Energy for space cooling												42.1158 (99)
Total												0.9936 (108)
Dwelling Fabric Energy Efficiency (DFEE)												43.1094 (109)
												43.1 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4130 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			6.8200	1.3258	9.0417		(27)
Heat Loss Floor 1			36.6200	0.1300	4.7606		(28a)
Brick Cavity	45.4900	11.1200	34.3700	0.1800	6.1866		(29a)
External Roof 1	36.6200		36.6200	0.1300	4.7606		(30)
Total net area of external elements Aum(A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4795		(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)							8.2145 (36)
Total fabric heat loss						(33) + (36) =	37.6940 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472
Heat transfer coeff	74.0457	73.8096	73.5782	72.4912	72.2879	71.3412	71.3412
Average = Sum(39)m / 12 =						71.1659	71.1659
HLP	1.0110	1.0078	1.0046	0.9898	0.9870	0.9741	0.9741
HLP (average)						0.9717	0.9717
Days in month	31	28	31	30	31	30	31
						30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)
Energy content (annual)										Total = Sum(45)m =		1405.8389 (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

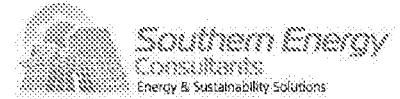
Elmhurst Energy Systems

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	30.9730	27.0892	27.9536	24.3707	23.3842	20.1788	18.6986	21.4570	21.7132	25.3047	27.6220	29.9957 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3899	18.9983	15.4505	11.6970	8.7436	7.3817	7.9762	10.3678	13.9157	17.6691	20.6225	21.9844	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	41.6304	40.3113	37.5721	33.8461	31.4304	28.0261	25.1326	28.8400	30.1572	34.0116	38.3639	40.3168	(72)
Total internal gains	325.5904	324.0042	312.3634	293.4884	273.7300	255.4418	244.1091	248.0836	258.3025	277.3079	299.0008	315.8377	(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
East											3.2400	19.6403	0.6300	0.7000	0.7700		19.4475 (76)
West											3.5800	19.6403	0.6300	0.7000	0.7700		21.4883 (80)
Solar gains	40.9358	80.0792	131.8790	192.3376	235.7169	241.2982	229.7258	197.3310	153.3807	95.0207	51.0422	33.6636	(83)				
Total gains	366.5262	404.0834	444.2424	485.8260	509.4470	496.7400	473.8349	445.4146	411.6831	372.3285	350.0430	349.5013	(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	68.6889	68.9086	69.1253	70.1617	70.3591	71.2928	71.2928	71.4684	70.9302	70.3591	69.9610	69.5495	
alpha	5.5793	5.5939	5.6084	5.6774	5.6906	5.7529	5.7529	5.7646	5.7287	5.6906	5.6641	5.6366	
util living area	0.9992	0.9984	0.9957	0.9841	0.9408	0.8138	0.6402	0.6973	0.9175	0.9907	0.9984	0.9994	(86)
MIT	19.8550	19.9668	20.1774	20.4729	20.7449	20.9306	20.9860	20.9777	20.8451	20.4939	20.1273	19.8405	(87)
Th 2	20.0742	20.0769	20.0795	20.0919	20.0942	20.1050	20.1050	20.1070	20.1008	20.0942	20.0895	20.0846	(88)
util rest of house	0.9989	0.9979	0.9941	0.9774	0.9140	0.7367	0.5213	0.5801	0.8695	0.9857	0.9977	0.9992	(89)
MIT 2	19.0192	19.1330	19.3451	19.6475	19.9076	20.0695	20.1010	20.0998	20.0051	19.6722	19.3039	19.0133	(90)
Living area fraction									fLA = Living area / (4) =			0.1802	(91)
MIT	19.1698	19.2833	19.4951	19.7962	20.0585	20.2247	20.2605	20.2581	20.1565	19.8203	19.4523	19.1624	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1698	19.2833	19.4951	19.7962	20.0585	20.2247	20.2605	20.2581	20.1565	19.8203	19.4523	19.1624	(93)

8. Space heating requirement

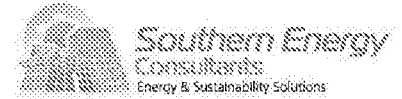
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9986	0.9972	0.9927	0.9746	0.9127	0.7482	0.5429	0.6013	0.8731	0.9836	0.9971	0.9989	(94)
Useful gains	365.9973	402.9548	440.9917	473.5029	464.9834	371.6805	257.2683	267.8321	359.4606	366.2248	349.0128	349.1187	(95)
Ext temp.	4.3000	4.9000	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	1101.0478	1061.6245	956.1554	789.8819	604.2207	401.2755	261.1437	274.5620	434.2858	666.5149	898.0033	1094.1880	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	546.8776	442.6260	383.2818	227.7929	103.5925	0.0000	0.0000	0.0000	0.0000	223.4159	395.2731	554.3316	(98)
Space heating												2877.1913	(98)
Space heating per m ²										(98) / (4) =		39.2844	(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	670.6073	527.9249	540.8608	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8504	0.9204	0.8974	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.3160	485.9137	485.3907	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	668.3074	639.8909	608.5423	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	70.5538	114.5590	91.6248	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												276.7377	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

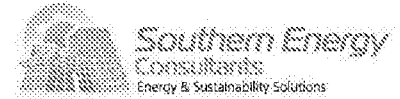


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	17.6385	28.6398	22.9062	0.0000	0.0000	0.0000 (107)
Space cooling											69.1844 (107)
Space cooling per m2											0.9446 (108)
Energy for space heating											39.2844 (99)
Energy for space cooling											0.9446 (108)
Total											40.2291 (109)
Target Fabric Energy Efficiency (TFEE)											46.3 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17941.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.9650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss						(33) + (36) =	42.1438 (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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	76.5390	76.1556	76.1556	75.6157	75.6157	74.9612	75.1178	74.8093	74.9612	75.2791	75.2791	75.7910 (39)
Average = Sum(39)m / 12 =												75.5233 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0450	1.0398	1.0398	1.0324	1.0324	1.0235	1.0256	1.0214	1.0235	1.0278	1.0278	1.0348 (40)
HLP (average)												1.0312 (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	2.3221 (42)
Average daily hot water use (litres/day)	89.3510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

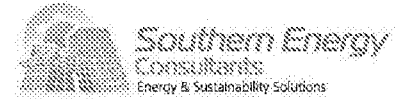
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
	Solar input (sum of months) = Sum(63)m =											0.0000 (63)	
Output from w/h	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
	Total per year (kWh/year) = Sum(64)m =											1570.8557 (64)	
RHI water heating demand	1571 (64)												
Heat gains from water heating, kWh/month													
	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4747	47.4958	38.6261	29.2425	21.8591	18.4544	19.9406	25.9195	34.7891	44.1728	51.5562	54.9609	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	529.6290	524.7493	503.5917	471.3569	438.7077	409.7832	393.2523	401.8727	420.8003	453.2391	488.9213	515.5732	(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
East					3.2400	22.3313	0.4400	0.0000	0.7700			24.5134
West					3.5800	22.3313	0.4400	0.0000	0.7700			27.0857 (76)

Solar gains	51.5991	90.7961	147.4368	220.9655	263.2897	288.2187	271.5137	238.8677	185.6630	114.9720	65.9115	42.0209 (83)
Total gains	581.2281	615.5453	651.0285	692.3224	701.9974	698.0019	664.7660	640.7404	606.4633	568.2111	554.8328	557.5941 (84)

7. Mean internal temperature (heating season)

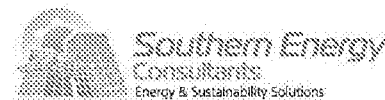
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.1129	65.4407	65.4407	65.9080	65.9080	66.4834	66.3448	66.6185	66.4834	66.2027	66.2027	65.7555
alpha	5.3409	5.3627	5.3627	5.3939	5.3939	5.4322	5.4230	5.4412	5.4322	5.4135	5.4135	5.3837
util living area	0.9898	0.9848	0.9675	0.9124	0.7747	0.5283	0.3495	0.3725	0.6792	0.9205	0.9794	0.9915 (86)
MIT	20.1473	20.2463	20.4602	20.7234	20.9187	20.9920	20.9993	20.9991	20.9695	20.7539	20.4198	20.1316 (87)
Th 2	20.0460	20.0503	20.0503	20.0564	20.0564	20.0638	20.0620	20.0655	20.0638	20.0602	20.0602	20.0544 (88)
util rest of house	0.9866	0.9800	0.9568	0.8838	0.7099	0.4337	0.2442	0.2644	0.5855	0.8880	0.9718	0.9887 (89)
MIT 2	18.9356	19.0815	19.3869	19.7519	19.9876	20.0601	20.0619	20.0653	20.0452	19.8018	19.3402	18.9193 (90)
Living area fraction	19.1540	19.2914	19.5804	19.9270	20.1554	20.2280	20.2309	20.2336	20.2118	19.9734	19.5348	19.1378 (91)
MIT	19.1540	19.2914	19.5804	19.9270	20.1554	20.2280	20.2309	20.2336	20.2118	19.9734	19.5348	19.1378 (92)
Temperature adjustment	19.0040	19.1414	19.4304	19.7770	20.0054	20.0780	20.0809	20.0836	20.0618	19.8234	19.3848	-0.1500
adjusted MIT	19.0040	19.1414	19.4304	19.7770	20.0054	20.0780	20.0809	20.0836	20.0618	19.8234	19.3848	18.9878 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	570.5666	599.3471	617.0013	604.9048	495.6190	303.7461	163.7590	170.7419	354.9391	498.8110	535.0286	548.8703	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1064.1948	1031.2564	916.1795	746.8557	529.7196	305.6931	163.8211	170.8362	364.4438	619.0497	857.0360	1052.5671	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	367.2594	290.2430	222.5886	102.2046	25.3708	0.0000	0.0000	0.0000	0.0000	89.4576	231.8454	374.7504	(98)
Space heating												1703.7199	(98)
RHI space heating demand												1704	(98)

FULL SAP CALCULATION PRINTOUT

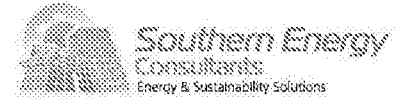
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17941.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.9650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss						(33) + (36) =	42.1438 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	78.4954	78.2594	78.0279	76.9410	76.7377	75.7910	75.7910	75.6157	76.1556	76.7377	77.1491	77.5792 (39)
Average = Sum(39)m / 12 =												76.9401 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0718	1.0685	1.0654	1.0505	1.0478	1.0348	1.0348	1.0324	1.0398	1.0478	1.0534	1.0592 (40)
HLP (average)												1.0505 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

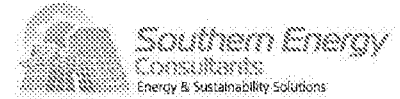
Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1405.8389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083 (61)
Total heat required for water heating calculated for each month											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)
Heat gains from water heating, kWh/month											
51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (65)
Total per year (kWh/year) = Sum(64)m =	1570.8557 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4747	47.4958	38.6261	29.2425	21.8591	18.4544	19.9406	25.9195	34.7891	44.1728	51.5562	54.9609	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	529.6290	524.7493	503.5917	471.3569	438.7077	409.7832	393.2523	401.8727	420.8003	453.2391	488.9213	515.5732	(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	
East					3.2400	19.6403	0.4400	0.0000	0.7700		21.5594 (76)	
West					3.5800	19.6403	0.4400	0.0000	0.7700		23.8218 (80)	
Solar gains	45.3811	88.7751	146.1999	213.2238	261.3138	267.5012	254.6720	218.7595	170.0365	105.3391	56.5849	37.3192 (83)
Total gains	575.0101	613.5243	649.7916	684.5808	700.0215	677.2844	647.9244	620.6322	590.8368	558.5782	545.5062	552.8924 (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	63.4900	63.6816	63.8704	64.7727	64.9443	65.7555	65.7555	65.9080	65.4407	64.9443	64.5980	64.2399
alpha	5.2327	5.2454	5.2580	5.3182	5.3296	5.3837	5.3837	5.3939	5.3627	5.3296	5.3065	5.2827
util living area	0.9924	0.9881	0.9762	0.9398	0.8500	0.6780	0.5076	0.5493	0.7896	0.9500	0.9862	0.9938 (86)
MIT	20.0213	20.1351	20.3420	20.6182	20.8424	20.9655	20.9939	20.9908	20.9216	20.6448	20.2910	20.0009 (87)
Th 2	20.0240	20.0266	20.0292	20.0414	20.0437	20.0544	20.0544	20.0564	20.0503	20.0437	20.0391	20.0343 (88)
util rest of house	0.9901	0.9844	0.9685	0.9197	0.8022	0.5930	0.4022	0.4423	0.7141	0.9291	0.9812	0.9918 (89)
MIT 2	18.7363	18.9030	19.2026	19.5989	19.8906	20.0314	20.0521	20.0526	19.9895	19.6436	19.1394	18.7142 (90)
Living area fraction	18.9679	19.1251	19.4080	19.7826	20.0621	20.1998	20.2218	20.2217	20.1574	19.8240	19.3470	18.9461 (92)
MIT	18.8179	18.9751	19.2580	19.6326	19.9121	20.0498	20.0718	20.0717	20.0074	19.6740	19.1970	18.7961 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.7961 (93)

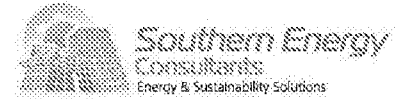
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9860	0.9789	0.9604	0.9091	0.7947	0.5925	0.4042	0.4441	0.7103	0.9188	0.9751	0.9883 (94)
Useful gains	566.9502	600.5683	624.0569	622.3780	556.2759	401.2987	261.9075	275.6205	419.6647	513.2018	531.9298	546.4091 (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	1139.5866	1101.5080	995.4781	825.7760	630.1794	413.0429	263.1331	277.6346	449.8856	696.3194	933.2686	1132.3555 (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	426.0414	336.6315	276.3374	146.4465	54.9842	0.0000	0.0000	0.0000	0.0000	136.2395	288.9639	435.9441 (98)
Space heating												2101.5885 (98)
Space heating per m2												(98) / (4) = 28.6945 (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												2322.1973 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	426.0414	336.6315	276.3374	146.4465	54.9842	0.0000	0.0000	0.0000	0.0000	136.2395	288.9639	435.9441 (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)	470.7640	371.9685	305.3452	161.8194	60.7561	0.0000	0.0000	0.0000	0.0000	150.5408	319.2971	481.7062 (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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)
Efficiency of water heater (217)m	89.6039	89.5351	89.3696	88.9774	88.2586	87.3000	87.3000	87.3000	87.3000	88.8899	89.4120	87.3000 (216)
Fuel for water heating, kWh/month	178.4028	156.5796	162.9086	144.1257	140.5209	124.2327	116.7468	131.6541	132.5400	149.7334	160.5984	173.1936 (219)
Water heating fuel used												1771.2366 (219)
Annual totals kWh/year												
Space heating fuel - main system												2322.1973 (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)												377.7519 (232)
Total delivered energy for all uses												4546.1858 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2322.1973	3.4800	80.8125 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1771.2366	3.4800	61.6390 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	377.7519	13.1900	49.8255 (250)
Additional standing charges			120.0000 (251)
Total energy cost			322.1695 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1444 (257)
SAP value	84.0359
SAP rating (Section 12)	84 (258)
SAP band	B

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

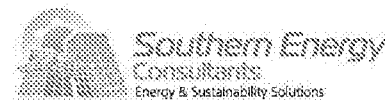
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2322.1973	0.2160	501.5946 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1771.2366	0.2160	382.5871 (264)
Space and water heating			884.1817 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.7519	0.5190	196.0533 (268)
Total kg/year			1119.1600 (272)
CO2 emissions per m2			15.2800 (273)
EI value			87.3167
EI rating			87 (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	$3.48 / 0.8857 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8857 = 0.2439$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =		0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17941.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.9650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss						(33) + (36) =	42.1438 (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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	76.5390	76.1556	76.1556	75.6157	75.6157	74.9612	75.1178	74.8093	74.9612	75.2791	75.2791	75.7910 (39)
Average = Sum(39)m / 12 =												75.5233 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0450	1.0398	1.0398	1.0324	1.0324	1.0235	1.0256	1.0214	1.0235	1.0278	1.0278	1.0348 (40)
HLP (average)												1.0312 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
								Total per year (kWh/year) = Sum(64)m =					1570.8557 (64)
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4747	47.4958	38.6261	29.2425	21.8591	18.4544	19.9406	25.9195	34.7891	44.1728	51.5562	54.9609 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550 (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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859 (71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184 (72)
Total internal gains	529.6290	524.7493	503.5917	471.3569	438.7077	409.7832	393.2523	401.8727	420.8003	453.2391	488.9213	515.5732 (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		
East				3.2400	22.3313	0.4400	0.0000	0.7700		24.5134 (76)		
West				3.5800	22.3313	0.4400	0.0000	0.7700		27.0857 (80)		

Solar gains	51.5991	90.7961	147.4368	220.9655	263.2897	288.2187	271.5137	238.8677	185.6630	114.9720	65.9115	42.0209 (83)
Total gains	581.2281	615.5453	651.0285	692.3224	701.9974	698.0019	664.7660	640.7404	606.4633	568.2111	554.8328	557.5941 (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	65.1129	65.4407	65.4407	65.9080	65.9080	66.4834	66.3448	66.6185	66.4834	66.2027	66.2027	65.7555
alpha	5.3409	5.3627	5.3627	5.3939	5.3939	5.4322	5.4230	5.4412	5.4322	5.4135	5.4135	5.3837
util living area	0.9898	0.9848	0.9675	0.9124	0.7747	0.5283	0.3495	0.3725	0.6792	0.9205	0.9794	0.9915 (86)
MIT	20.1473	20.2463	20.4602	20.7234	20.9187	20.9920	20.9993	20.9991	20.9695	20.7539	20.4198	20.1316 (87)
Th 2	20.0460	20.0503	20.0503	20.0564	20.0564	20.0638	20.0620	20.0655	20.0638	20.0602	20.0602	20.0544 (88)
util rest of house	0.9866	0.9800	0.9568	0.8838	0.7099	0.4337	0.2442	0.2644	0.5855	0.8880	0.9718	0.9887 (89)
MIT 2	18.9356	19.0815	19.3869	19.7519	19.9876	20.0601	20.0619	20.0653	20.0452	19.8018	19.3402	18.9193 (90)
Living area fraction	19.1540	19.2914	19.5804	19.9270	20.1554	20.2280	20.2309	20.2336	20.2118	19.9734	19.5348	19.1378 (92)
MIT	19.0040	19.1414	19.4304	19.7770	20.0054	20.0780	20.0809	20.0836	20.0618	19.8234	19.3848	18.9878 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.9878 (93)

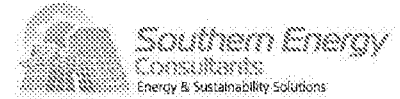
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9817	0.9737	0.9477	0.8737	0.7060	0.4352	0.2463	0.2665	0.5853	0.8779	0.9643	0.9844 (94)
Useful gains	570.5666	599.3471	617.0013	604.9048	495.6190	303.7461	163.7590	170.7419	354.9391	498.8110	535.0286	548.8703 (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	1064.1948	1031.2564	916.1795	746.8557	529.7196	305.6931	163.8211	170.8362	364.4438	619.0497	857.0360	1052.5671 (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	367.2594	290.2430	222.5886	102.2046	25.3708	0.0000	0.0000	0.0000	0.0000	89.4576	231.8454	374.7504 (98)
Space heating												1703.7199 (98)
Space heating per m2										(98) / (4) =		23.2621 (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													1882.5634 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	367.2594	290.2430	222.5886	102.2046	25.3708	0.0000	0.0000	0.0000	0.0000	89.4576	231.8454	374.7504	(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)	405.8115	320.7105	245.9543	112.9333	28.0341	0.0000	0.0000	0.0000	0.0000	98.8482	256.1827	414.0888	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)
Efficiency of water heater (217)m	89.5050	89.4323	89.2070	88.6909	87.8274	87.3000	87.3000	87.3000	87.3000	88.5587	89.2488	87.3000	(216)
Fuel for water heating, kWh/month	178.5998	156.7595	163.2056	144.5913	141.2108	124.2327	116.7468	131.6541	132.5400	150.2933	160.8921	173.3842	(219)
Water heating fuel used												1774.1103	(219)
Annual totals kWh/year													
Space heating fuel - main system												1882.5634	(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)												377.7519	(232)
Total delivered energy for all uses												4109.4256	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1882.5634	3.8700	72.8552 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1774.1103	3.8700	68.6581 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	377.7519	18.9000	71.3951 (250)
Additional standing charges			93.0000 (251)
Total energy cost			320.0834 (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	1882.5634	0.2160	406.6337 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.1103	0.2160	383.2078 (264)
Space and water heating			789.8415 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	377.7519	0.5190	196.0533 (268)
Total kg/year			1024.8198 (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	1882.5634	1.2200	2296.7273 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.1103	1.2200	2164.4146 (264)
Space and water heating			4461.1419 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	377.7519	3.0700	1159.6985 (268)
Primary energy kWh/year			5851.0903 (272)
Primary energy kWh/m2/year			79.8893 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 87

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	+ 1.3	-£ 27	-178 kg (17.3%)
U Solar photovoltaic panels	+ 11.3	-£ 345	-947 kg (111.7%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£27	2.42 kg/m²	B 85	B 89
Solar photovoltaic panels	£345	12.93 kg/m²	A 97	A 99
Total Savings	£372	15.35 kg/m²		

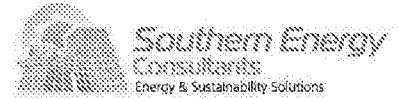
Potential energy efficiency rating: A 97
 Potential environmental impact rating: A 99

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	£86	£95	-£9
Mains gas	£235	£198	£36
Space heating	£180	£180	£0
Water heating	£69	£42	£27
Lighting	£71	£71	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£321	-£52	£372
Total cost of uses	£320	-£52	£372
Delivered energy	56 kWh/m²	19 kWh/m²	37 kWh/m²
Carbon dioxide emissions	1.0 tonnes	-0.1 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	-1 kg/m²	15 kg/m²
Primary energy	80 kWh/m²	-10 kWh/m²	90 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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) = 0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17941.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.9650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss							(33) + (36) = 42.1438 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	78.4954	78.2594	78.0279	76.9410	76.7377	75.7910	75.7910	75.6157	76.1556	76.7377	77.1491	77.5792 (39)
Average = Sum(39)m / 12 =												76.9401 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0718	1.0685	1.0654	1.0505	1.0478	1.0348	1.0348	1.0324	1.0398	1.0478	1.0534	1.0592 (40)
HLP (average)												1.0505 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1405.8389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083 (61)
Total heat required for water heating calculated for each month											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-24.0687	-40.1637	-68.4033	-91.6739	-113.2554	-111.3481	-109.8766	-95.9997	-75.1871	-51.3439	-28.5489
Solar input (sum of months) = Sum(63)m =											
Output from w/h	135.7871	100.0300	77.1875	36.5653	10.7664	0.0000	0.0000	18.9342	40.5203	81.7539	115.0453
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224
51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4747	47.4958	38.6261	29.2425	21.8591	18.4544	19.9406	25.9195	34.7891	44.1728	51.5562	54.9609 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550 (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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859 (71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184 (72)
Total internal gains	529.6290	524.7493	503.5917	471.3569	438.7077	409.7832	393.2523	401.8727	420.8003	453.2391	488.9213	515.5732 (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	
East					3.2400	19.6403	0.4400		0.0000	0.7700	21.5594 (76)	
West					3.5800	19.6403	0.4400		0.0000	0.7700	23.8218 (80)	

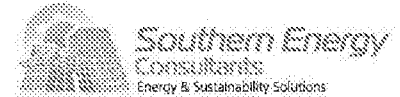
Solar gains	45.3811	88.7751	146.1999	213.2238	261.3138	267.5012	254.6720	218.7595	170.0365	105.3391	56.5849	37.3192 (83)
Total gains	575.0101	613.5243	649.7916	684.5808	700.0215	677.2844	647.9244	620.6322	590.8368	558.5782	545.5062	552.8924 (84)

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	63.4900	63.6816	63.8704	64.7727	64.9443	65.7555	65.7555	65.9080	65.4407	64.9443	64.5980	64.2399
alpha	5.2327	5.2454	5.2580	5.3182	5.3296	5.3837	5.3837	5.3939	5.3627	5.3296	5.3065	5.2827
util living area	0.9924	0.9881	0.9762	0.9398	0.8500	0.6780	0.5076	0.5493	0.7896	0.9500	0.9862	0.9938 (86)
MIT	20.0213	20.1351	20.3420	20.6182	20.8424	20.9655	20.9939	20.9908	20.9216	20.6448	20.2910	20.0009 (87)
Th 2	20.0240	20.0266	20.0292	20.0414	20.0437	20.0544	20.0544	20.0564	20.0503	20.0437	20.0391	20.0343 (88)
util rest of house	0.9901	0.9844	0.9685	0.9197	0.8022	0.5930	0.4022	0.4423	0.7141	0.9291	0.9812	0.9918 (89)
MIT 2	18.7363	18.9030	19.2026	19.5989	19.8906	20.0314	20.0521	20.0526	19.9895	19.6436	19.1394	18.7142 (90)
Living area fraction	fLA = Living area / (4) =											0.1802 (91)
MIT	18.9679	19.1251	19.4080	19.7826	20.0621	20.1998	20.2218	20.2217	20.1574	19.8240	19.3470	18.9461 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8179	18.9751	19.2580	19.6326	19.9121	20.0498	20.0718	20.0717	20.0074	19.6740	19.1970	18.7961 (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	0.9860	0.9789	0.9604	0.9091	0.7947	0.5925	0.4042	0.4441	0.7103	0.9188	0.9751	0.9883	(94)
Useful gains	566.9502	600.5683	624.0569	622.3780	556.2759	401.2987	261.9075	275.6205	419.6647	513.2018	531.9298	546.4091	(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													
	1139.5866	1101.5080	995.4781	825.7760	630.1794	413.0429	263.1331	277.6346	449.8856	696.3194	933.2686	1132.3555	(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													
	426.0414	336.6315	276.3374	146.4465	54.9842	0.0000	0.0000	0.0000	0.0000	136.2395	288.9639	435.9441	(98)
Space heating												2101.5885	(98)
Space heating per m2											(98) / (4) =	28.6945	(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													2322.1973 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	426.0414	336.6315	276.3374	146.4465	54.9842	0.0000	0.0000	0.0000	0.0000	136.2395	288.9639	435.9441	(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)	470.7640	371.9685	305.3452	161.8194	60.7561	0.0000	0.0000	0.0000	0.0000	150.5408	319.2971	481.7062	(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	135.7871	100.0300	77.1875	36.5653	10.7664	0.0000	0.0000	18.9342	40.5203	81.7539	115.0453	135.1045	(64)
Efficiency of water heater	89.7053	89.7464	89.7815	89.8420	89.9600	87.3000	87.3000	87.3000	87.3000	89.2728	89.5651	89.7219	(217)
Fuel for water heating, kWh/month	151.3703	111.4585	85.9726	40.6996	11.9679	0.0000	0.0000	21.6887	46.4150	91.5776	128.4488	150.5814	(219)
Water heating fuel used												840.1805	(219)
Annual totals kWh/year													
Space heating fuel - main system													2322.1973 (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)													377.7519 (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													1937.8903 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2322.1973	3.4800	80.8125 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	840.1805	3.4800	29.2383 (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	377.7519	13.1900	49.8255 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			68.5409 (255)

11a. SAP rating - Individual heating systems

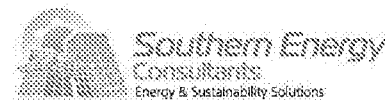
Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.2435 (257)
SAP value			96.6037
SAP rating (Section 12)			97 (258)
SAP band			A

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	2322.1973	0.2160	501.5946 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	840.1805	0.2160	181.4790 (264)
Space and water heating			683.0736 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	377.7519	0.5190	196.0533 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			47.5646 (272)
CO2 emissions per m2			0.6500 (273)
EI value			99.4610
EI rating			99 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =		0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (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)			6.8200	1.2357	8.4278		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1600	5.8592	75.0000	2746.5000 (28a)
Brick Cavity	45.4900	11.1200	34.3700	0.2500	8.5925	60.0000	2062.2000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			118.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.3577		(33)
Party Wall 1			79.9400	0.0000	0.0000	110.0000	8793.4000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17941.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.9650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7861 (36)
Total fabric heat loss						(33) + (36) =	42.1438 (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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	76.5390	76.1556	76.1556	75.6157	75.6157	74.9612	75.1178	74.8093	74.9612	75.2791	75.2791	75.7910 (39)
Average = Sum(39)m / 12 =												75.5233 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0450	1.0398	1.0398	1.0324	1.0324	1.0235	1.0256	1.0214	1.0235	1.0278	1.0278	1.0348 (40)
HLP (average)												1.0312 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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												1.3624 (H8)	
Utilisation factor												0.5200 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												89.3510 (H14)	
Volume ratio Veff/V												0.8394 (H15)	
Solar storage volume factor												0.9650 (H16)	
Solar input												-845.1092 (H17)	
Solar input	-26.0120	-39.0960	-65.8427	-91.0148	-109.6124	-115.3623	-112.5922	-100.5455	-78.4761	-53.3858	-31.6183	-21.5511 (63)	
	Solar input (sum of months) = Sum(63)m =											-845.1092 (63)	
Output from w/h	133.8438	101.0976	79.7481	37.2245	14.4094	0.0000	0.0000	14.3885	37.2313	79.7119	111.9759	133.6947 (64)	
	Total per year (kWh/year) = Sum(64)m =											743.3258 (64)	
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.4747	47.4958	38.6261	29.2425	21.8591	18.4544	19.9406	25.9195	34.7891	44.1728	51.5562	54.9609	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	529.6290	524.7493	503.5917	471.3569	438.7077	409.7832	393.2523	401.8727	420.8003	453.2391	488.9213	515.5732	(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	
East					3.2400	22.3313	0.4400		0.0000	0.7700	24.5134 (76)	
West					3.5800	22.3313	0.4400		0.0000	0.7700	27.0857 (80)	

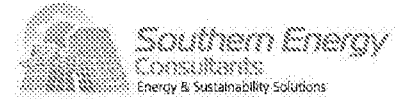
Solar gains	51.5991	90.7961	147.4368	220.9655	263.2897	288.2187	271.5137	238.8677	185.6630	114.9720	65.9115	42.0209 (83)
Total gains	581.2281	615.5453	651.0285	692.3224	701.9974	698.0019	664.7660	640.7404	606.4633	568.2111	554.8328	557.5941 (84)

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	65.1129	65.4407	65.4407	65.9080	65.9080	66.4834	66.3448	66.6185	66.4834	66.2027	66.2027	65.7555	
alpha	5.3409	5.3627	5.3627	5.3939	5.3939	5.4322	5.4230	5.4412	5.4322	5.4135	5.4135	5.3837	
util living area	0.9898	0.9848	0.9675	0.9124	0.7747	0.5283	0.3495	0.3725	0.6792	0.9205	0.9794	0.9915 (86)	
MIT	20.1473	20.2463	20.4602	20.7234	20.9187	20.9920	20.9993	20.9991	20.9695	20.7539	20.4198	20.1316 (87)	
Th 2	20.0460	20.0503	20.0503	20.0564	20.0564	20.0638	20.0620	20.0655	20.0638	20.0602	20.0602	20.0544 (88)	
util rest of house	0.9866	0.9800	0.9568	0.8838	0.7099	0.4337	0.2442	0.2644	0.5855	0.8880	0.9718	0.9887 (89)	
MIT 2	18.9356	19.0815	19.3869	19.7519	19.9876	20.0601	20.0619	20.0653	20.0452	19.8018	19.3402	18.9193 (90)	
Living area fraction	fLA = Living area / (4) =												0.1802 (91)
MIT	19.1540	19.2914	19.5804	19.9270	20.1554	20.2280	20.2309	20.2336	20.2118	19.9734	19.5348	19.1378 (92)	
Temperature adjustment													-0.1500
adjusted MIT	19.0040	19.1414	19.4304	19.7770	20.0054	20.0780	20.0809	20.0836	20.0618	19.8234	19.3848	18.9878 (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	0.9817	0.9737	0.9477	0.8737	0.7060	0.4352	0.2463	0.2665	0.5853	0.8779	0.9643	0.9844	(94)
Useful gains	570.5666	599.3471	617.0013	604.9048	495.6190	303.7461	163.7590	170.7419	354.9391	498.8110	535.0286	548.8703	(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	1064.1948	1031.2564	916.1795	746.8557	529.7196	305.6931	163.8211	170.8362	364.4438	619.0497	857.0360	1052.5671	(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	367.2594	290.2430	222.5886	102.2046	25.3708	0.0000	0.0000	0.0000	0.0000	89.4576	231.8454	374.7504	(98)
Space heating												1703.7199	(98)
Space heating per m2											(98) / (4) =	23.2621	(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													1882.5634 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	367.2594	290.2430	222.5886	102.2046	25.3708	0.0000	0.0000	0.0000	0.0000	89.4576	231.8454	374.7504	(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)	405.8115	320.7105	245.9543	112.9333	28.0341	0.0000	0.0000	0.0000	0.0000	98.8482	256.1827	414.0888	(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	133.8438	101.0976	79.7481	37.2245	14.4094	0.0000	0.0000	14.3885	37.2313	79.7119	111.9759	133.6947	(64)
Efficiency of water heater	89.6225	89.6511	89.6334	89.6229	89.3141	87.3000	87.3000	87.3000	87.3000	88.9634	89.4324	89.6360	(216)
(217)m	89.6225	89.6511	89.6334	89.6229	89.3141	87.3000	87.3000	87.3000	87.3000	88.9634	89.4324	89.6360	(217)
Fuel for water heating, kWh/month	149.3416	112.7679	88.9715	41.5346	16.1334	0.0000	0.0000	16.4817	42.6475	89.6008	125.2074	149.1529	(219)
Water heating fuel used												831.8392	(219)
Annual totals kWh/year													
Space heating fuel - main system												1882.5634	(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)												377.7519	(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												1392.9949	(238)

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

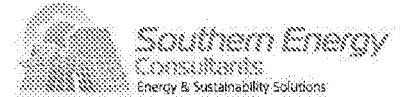
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1882.5634	3.8700	72.8552	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	831.8392	3.8700	32.1922	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	377.7519	18.9000	71.3951	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			-51.6987	(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	1882.5634	0.2160	406.6337	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	831.8392	0.2160	179.6773	(264)
Space and water heating			586.3110	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	377.7519	0.5190	196.0533	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			-99.4996	(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	1882.5634	1.2200	2296.7273 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	831.8392	1.2200	1014.8438 (264)
Space and water heating			3311.5711 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	377.7519	3.0700	1159.6985 (268)
Energy saving/generation technologies			
FV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-745.1505 (272)
Primary energy kWh/m2/year			-10.1741 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	245.0 (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	242.18 (P1)
Transmission heat loss coefficient	42.14 (37)
Summer heat loss coefficient	284.32 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.2400	117.5071	0.4400	0.0000	0.9000	150.7663
West	3.5800	117.5071	0.4400	0.0000	0.9000	166.5874

total: 317.3537

Solar gains	Jun	Jul	Aug	(P4)
Internal gains	407	390	399	
Total summer gains	744	708	678	(P5)

Summer gain/loss ratio	2.62	2.49	2.38	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 245.0)	0.29	0.29	0.29	
Threshold temperature	18.90	20.67	20.47	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight