

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BD23 6RR Plot 30			Issued on Date	20/07/2022
Assessment Reference	001	Prop Type Ref	Type A		
Property	Plot 30, Phase 3, Shires Lane, Embsay, Skipton, BD23 6RR				
SAP Rating	89 B	DER	11.52	TER	19.78
Environmental	92 A	% DER<TER	41.75		
CO₂ Emissions (t/year)	0.94	DFEE	58.18	TFEE	59.56
General Requirements Compliance	Pass	% DFEE<TFEE	2.30		
Assessor Details	Mr. Jake Eaton, Jake Eaton, Tel: 01400283471, jake@eratech.co.uk			Assessor ID	P711-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 83 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.78 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 59.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 58.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.63 (max. 2.00)	1.80 (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 manufacturer rated a

Combi boiler
Efficiency: 90%
Minimum: 88% OK

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%
Minimum: 65% OK

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

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1600
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (North East England): Not significant OK

Based on:

Overshading: Average
Windows facing East: 8.27 m², No overhang
Windows facing South: 0.68 m², No overhang
Windows facing West: 3.87 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 50% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array 1.50 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2350		(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			18.0000	708.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19628.6200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							236.7176 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss						(33) + (36) =	76.1269 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	35.7076	35.3435	34.9793	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725 (38)
Heat transfer coeff	111.8345	111.4703	111.1062	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993 (39)
Average = Sum(39)m / 12 =												110.6671 (39)
HLP	1.3487	1.3443	1.3399	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314 (40)
HLP (average)												1.3346 (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	2.5159 (42)
Average daily hot water use (litres/day)	93.9534 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy conte	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)	Total = Sum(45)m = 1478.2535 (45)											
Distribution loss (46)m = 0.15 x (45)m	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641 (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	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589 (61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (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	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (64)
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918 (65)
Total per year (kWh/year) = Sum(64)m = 2038.4067 (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	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8275	18.4988	15.0443	11.3895	8.5138	7.1877	7.7665	10.0952	13.5498	17.2046	20.0803	21.4064 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4349	227.7742	221.8792	209.3295	193.4877	178.5987	168.6519	166.3126	172.2076	184.7573	200.5991	215.4881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797 (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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374 (71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567 (72)
Total internal gains	395.6194	393.3896	378.8897	355.9146	332.5757	310.1160	295.9873	302.7200	314.8804	338.0701	364.5919	384.0902 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	8.2700	19.6403	0.7600	0.7500	0.7700	64.1595 (76)						
South	0.6800	46.7521	0.7600	0.7500	0.7700	12.5579 (78)						
West	3.8700	19.6403	0.7600	0.7500	0.7700	30.0238 (80)						
Solar gains	106.7413	204.8092	329.6196	472.1316	573.1823	584.8623	557.5557	482.1860	380.2587	240.8024	132.3210	88.3030 (83)
Total gains	502.3606	598.1988	708.5092	828.0462	905.7581	894.9783	853.5430	784.9060	695.1391	578.8725	496.9128	472.3932 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9972	0.9938	0.9830	0.9470	0.8581	0.7051	0.5461	0.6079	0.8462	0.9731	0.9946	0.9979 (86)
tau	19.7686	19.9102	20.1539	20.4640	20.7231	20.8722	20.9201	20.9106	20.7882	20.4356	20.0452	19.7512 (87)
alpha	19.8029	19.8063	19.8097	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163 (88)
util living area	0.9963	0.9917	0.9770	0.9276	0.8067	0.6052	0.4103	0.4695	0.7699	0.9597	0.9925	0.9972 (89)
MIT	18.1663	18.3752	18.7310	19.1752	19.5163	19.6809	19.7178	19.7131	19.6036	19.1440	18.5806	18.1509 (90)
Living area fraction	18.6899	18.8768	19.1960	19.5964	19.9107	20.0702	20.1108	20.1045	19.9907	19.5661	19.0593	18.6740 (92)
MIT 2	18.5399	18.7268	19.0460	19.4464	19.7607	19.9202	19.9608	19.9545	19.8407	19.4161	18.9093	18.5240 (93)
Temperature adjustment adjusted MIT	fLA = Living area / (4) = 0.3268 (91)											

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	499.8035	591.6656	688.5984	761.7563	728.0670	550.2491	365.0845	382.1409	536.5068	551.9364	491.9887	470.5375 (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	1592.5166	1541.2823	1393.9407	1164.3189	889.8952	587.3510	371.0258	392.4116	633.7709	973.2930	1303.7383	1581.3548 (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 (98a)
Space heating kWh	812.9785	638.1424	524.7747	289.8450	120.4001	0.0000	0.0000	0.0000	0.0000	313.4893	584.4597	826.4481 (98)
Space heating	Space heating per m2 (98) / (4) = 49.5723 (99)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													91.9000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													4025.5539 (211)
Space heating requirement	812.9785	638.1424	524.7747	289.8450	120.4001	0.0000	0.0000	0.0000	0.0000	313.4893	584.4597	826.4481	(98)
Space heating efficiency (main heating system 1)	91.9000	91.9000	91.9000	91.9000	91.9000	0.0000	0.0000	0.0000	0.0000	91.9000	91.9000	91.9000	(210)
Space heating fuel (main heating system)	796.1705	624.9490	513.9251	283.8526	117.9109	0.0000	0.0000	0.0000	0.0000	307.0080	572.3762	809.3616	(211)
Water heating requirement	125.0736	98.1758	80.7346	44.5915	18.5231	0.0000	0.0000	0.0000	0.0000	48.2291	89.9169	127.1459	(215)
Water heating requirement	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	228.1812	200.9877	209.1147	185.4742	179.5718	158.1568	151.5262	168.9162	170.7817	194.4690	207.5919	222.7779	(219)
Water heating fuel used													2277.5494 (219)
Annual totals kWh/year													
Space heating fuel - main system													4025.5539 (211)
Space heating fuel - secondary													632.3904 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													46.6272 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													121.6272 (231)
Electricity for lighting (calculated in Appendix L)													367.8206 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.50 * 1080 * 1.00) =										-1295.4295			-1295.4295 (233)
Total delivered energy for all uses													6129.5120 (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	4025.5539	0.2160	869.5196	(261)
Space heating - secondary	632.3904	0.0190	12.0154	(263)
Water heating (other fuel)	2277.5494	0.2160	491.9507	(264)
Space and water heating			1373.4857	(265)
Pumps and fans	121.6272	0.5190	63.1245	(267)
Energy for lighting	367.8206	0.5190	190.8989	(268)
Energy saving/generation technologies				
PV Unit	-1295.4295	0.5190	-672.3279	(269)
Total CO2, kg/year			955.1812	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.5200	(273)

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

DER		11.5200	ZC1
Total Floor Area		82.9200	TFA
Assumed number of occupants		2.5159	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		16.1105	ZC2
CO2 emissions from cooking, equation (L16)		2.1633	ZC3
Total CO2 emissions		29.7938	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.7938	ZC8

FULL SAP CALCULATION PRINTOUT

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (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) = 0.1444 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3944 (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) =	0.3353 (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	0.4275	0.4191	0.4107	0.3688	0.3604	0.3185	0.3185	0.3101	0.3353	0.3604	0.3772	0.3939 (22b)
Effective ac	0.5914	0.5878	0.5843	0.5680	0.5649	0.5507	0.5507	0.5481	0.5562	0.5649	0.5711	0.5776 (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 Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Heat Loss Floor 1			8.2500	0.1300	1.0725		(28a)
Heat Loss Floor 2			31.1500	0.1300	4.0495		(28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398		(29a)
Wall To Garage	13.7800		13.7800	0.1800	2.4804		(29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220		(30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		48.3044 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.4717 (36)
 Total fabric heat loss (33) + (36) = 62.7761 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.5349	40.2918	40.0534	38.9338	38.7243	37.7492	37.7492	37.5686	38.1248	38.7243	39.1481	39.5911 (38)
Heat transfer coeff	103.3111	103.0679	102.8295	101.7099	101.5005	100.5253	100.5253	100.3448	100.9009	101.5005	101.9242	102.3672 (39)
Average = Sum(39)m / 12 =												101.7089 (39)
HLP	1.2459	1.2430	1.2401	1.2266	1.2241	1.2123	1.2123	1.2101	1.2168	1.2241	1.2292	1.2345 (40)
HLP (average)												1.2266 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5159 (42)
Average daily hot water use (litres/day)												93.9534 (43)
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy conte	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)												Total = Sum(45)m = 1478.2535 (45)
Distribution loss (46)m = 0.15 x (45)m	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	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	0.0000	0.0000	(57)
Combi loss	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	199.3862	199.3862	(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	0.0000	0.0000	(63)
Output from w/h	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	199.3862	199.3862	(64)
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918	62.0918	62.0918	(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	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1125	18.7519	15.2501	11.5453	8.6303	7.2860	7.8728	10.2334	13.7352	17.4400	20.3551	21.6993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4349	227.7742	221.8792	209.3295	193.4877	178.5987	168.6519	166.3126	172.2076	184.7573	200.5991	215.4881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	(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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	(71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567	(72)
Total internal gains	395.9044	393.6427	379.0955	356.0704	332.6922	310.2144	296.0936	302.8582	315.0658	338.3055	364.8666	384.3831	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	8.2700	19.6403	0.6300	0.6300	0.7000	0.7700	49.6392	(76)					
South	0.6800	46.7521	0.6300	0.6300	0.7000	0.7700	9.7159	(78)					
West	3.8700	19.6403	0.6300	0.6300	0.7000	0.7700	23.2290	(80)					
Solar gains	82.5840	158.4577	255.0215	365.2808	443.4621	452.4987	431.3720	373.0597	294.2002	186.3050	102.3746	68.3186	(83)
Total gains	478.4884	552.1004	634.1170	721.3512	776.1543	762.7131	727.4656	675.9178	609.2660	524.6105	467.2413	452.7018	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	55.7378	55.8693	55.9988	56.6153	56.7321	57.2824	57.2824	57.3855	57.0692	56.7321	56.4962	56.2517		
alpha	4.7159	4.7246	4.7333	4.7744	4.7821	4.8188	4.8188	4.8257	4.8046	4.7821	4.7664	4.7501		
util living area	0.9983	0.9963	0.9899	0.9662	0.8971	0.7510	0.5851	0.6444	0.8779	0.9819	0.9966	0.9987	(86)	
MIT	19.6112	19.7645	20.0380	20.4038	20.7232	20.9210	20.9813	20.9708	20.8195	20.3960	19.9381	19.5860	(87)	
Th 2	19.8834	19.8858	19.8880	19.8988	19.9008	19.9102	19.9102	19.9119	19.9065	19.9008	19.8967	19.8925	(88)	
util rest of house	0.9977	0.9950	0.9861	0.9525	0.8547	0.6569	0.4516	0.5103	0.8111	0.9723	0.9952	0.9982	(89)	
MIT 2	18.0369	18.2623	18.6617	19.1927	19.6241	19.8563	19.9033	19.8997	19.7563	19.1905	18.5242	18.0064	(90)	
Living area fraction									FLA = Living area / (4) =				0.3268	(91)
MIT	18.5514	18.7533	19.1115	19.5885	19.9833	20.2043	20.2556	20.2497	20.1038	19.5845	18.9863	18.5226	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.5514	18.7533	19.1115	19.5885	19.9833	20.2043	20.2556	20.2497	20.1038	19.5845	18.9863	18.5226	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	476.8743	548.2814	622.9698	683.5676	666.2318	522.0888	360.5799	374.7305	502.8535	508.0998	464.1689	451.5225	(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	1472.3309	1427.8275	1296.8346	1087.1259	840.7603	563.3731	367.4789	386.3018	605.7848	911.9294	1211.5017	1466.1677	(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	740.6197	591.0550	501.3554	290.5620	129.8492	0.0000	0.0000	0.0000	0.0000	300.4492	538.0796	754.8961	(98)
Space heating												3846.8662	(98)
Space heating per m2												46.3925	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													4118.7004 (211)
Space heating requirement	740.6197	591.0550	501.3554	290.5620	129.8492	0.0000	0.0000	0.0000	0.0000	300.4492	538.0796	754.8961	(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)	792.9547	632.8212	536.7831	311.0942	139.0248	0.0000	0.0000	0.0000	0.0000	321.6801	576.1023	808.2399	(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	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	(64)
Efficiency of water heater (217)m	88.0074	87.8226	87.4114	86.4467	84.5199	80.3000	80.3000	80.3000	80.3000	86.4132	87.5729	88.0851	(216)
Fuel for water heating, kWh/month	232.0511	204.8266	214.1113	192.0252	190.1524	176.2769	168.8867	188.2690	190.3483	201.4157	212.1601	226.3562	(219)
Water heating fuel used													2396.8796 (219)
Annual totals kWh/year													
Space heating fuel - main system													4118.7004 (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)													372.8536 (232)
Total delivered energy for all uses													6963.4336 (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	4118.7004	0.2160	889.6393 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2396.8796	0.2160	517.7260 (264)
Space and water heating			1407.3653 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.8536	0.5190	193.5110 (268)
Total CO2, kg/m2/year			1639.8013 (272)
Emissions per m2 for space and water heating			16.9726 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3337 (272b)
Emissions per m2 for pumps and fans			0.4694 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.9726 * 1.00) + 2.3337 + 0.4694, rounded to 2 d.p.			19.7800 (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	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) =					Air changes per hour 30.0000 / (5) = 0.1444 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3944 (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) =	0.3353 (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	0.4275	0.4191	0.4107	0.3688	0.3604	0.3185	0.3185	0.3101	0.3353	0.3604	0.3772	0.3939 (22b)
Effective ac	0.5914	0.5878	0.5843	0.5680	0.5649	0.5507	0.5507	0.5481	0.5562	0.5649	0.5711	0.5776 (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			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m ²)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.2350		(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			9.0000	354.4200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19274.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							232.4433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss						(33) + (36) =	76.1269 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.5349	40.2918	40.0534	38.9338	38.7243	37.7492	37.7492	37.5686	38.1248	38.7243	39.1481	39.5911 (38)
Average = Sum(39)m / 12 =	116.6618	116.4186	116.1803	115.0607	114.8512	113.8761	113.8761	113.6955	114.2517	114.8512	115.2750	115.7180 (39)
HLP	1.4069	1.4040	1.4011	1.3876	1.3851	1.3733	1.3733	1.3711	1.3779	1.3851	1.3902	1.3955 (40)
HLP (average)												1.3876 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5159 (42)
Average daily hot water use (litres/day)												93.9534 (43)
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)	Total = Sum(45)m = 1478.2535 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
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 (57)
Heat gains from water heating, kWh/month	32.5684	28.4846	29.3935	25.6260	24.5887	21.2182	19.6618	22.5622	22.8317	26.6081	29.0448	31.5408 (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	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8275	18.4988	15.0443	11.3895	8.5138	7.1877	7.7665	10.0952	13.5498	17.2046	20.0803	21.4064 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4349	227.7742	221.8792	209.3295	193.4877	178.5987	168.6519	166.3126	172.2076	184.7573	200.5991	215.4881 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797 (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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374 (71)
Water heating gains (Table 5)	43.7748	42.3878	39.5074	35.5916	33.0494	29.4697	26.4271	30.3255	31.7106	35.7636	40.3400	42.3935 (72)
Total internal gains	350.7762	349.3998	337.1699	317.0496	295.7899	275.9951	263.5846	267.4724	278.2071	298.4645	321.7584	340.0271 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
East	8.2700	19.6403	0.7600	0.7600	0.7500	0.7700	64.1595 (76)					
South	0.6800	46.7521	0.7600	0.7600	0.7500	0.7700	12.5579 (78)					
West	3.8700	19.6403	0.7600	0.7600	0.7500	0.7700	30.0238 (80)					
Solar gains	106.7413	204.8092	329.6196	472.1316	573.1823	584.8623	557.5557	482.1860	380.2587	240.8024	132.3210	88.3030 (83)
Total gains	457.5175	554.2090	666.7895	789.1812	868.9722	860.8574	821.1403	749.6584	658.4658	539.2669	454.0794	428.3300 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	45.8929	45.9887	46.0831	46.5315	46.6164	47.0155	47.0155	47.0902	46.8610	46.6164	46.4450	46.2672
alpha	4.0595	4.0659	4.0722	4.1021	4.1078	4.1344	4.1344	4.1393	4.1241	4.1078	4.0963	4.0845
util living area	0.9979	0.9950	0.9860	0.9553	0.8774	0.7331	0.5767	0.6413	0.8698	0.9787	0.9959	0.9984 (86)
MIT	19.2956	19.4877	19.8251	20.2681	20.6493	20.8877	20.9684	20.9514	20.7524	20.2352	19.6819	19.2637 (87)
Th 2	19.7580	19.7603	19.7625	19.7728	19.7748	19.7838	19.7838	19.7855	19.7804	19.7748	19.7709	19.7668 (88)
util rest of house	0.9971	0.9933	0.9810	0.9384	0.8295	0.6328	0.4330	0.4971	0.7990	0.9678	0.9942	0.9978 (89)
MIT 2	18.2188	18.4119	18.7483	19.1875	19.5378	19.7315	19.7758	19.7714	19.6392	19.1647	18.6143	18.1936 (90)
Living area fraction	fLA = Living area / (4) =											0.3268 (91)
MIT	18.5707	18.7635	19.1002	19.5406	19.9010	20.1093	20.1656	20.1571	20.0030	19.5146	18.9632	18.5434 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5707	18.7635	19.1002	19.5406	19.9010	20.1093	20.1656	20.1571	20.0030	19.5146	18.9632	18.5434 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	455.7627	549.4727	651.7452	737.3703	725.7704	570.0905	394.5598	408.1960	536.2272	520.2143	450.7519	427.0717 (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	1664.8492	1613.9673	1463.8952	1224.3195	941.8993	627.3811	406.0311	427.1605	674.4266	1023.8468	1367.5264	1659.7848 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	899.5604	715.3404	604.2396	350.6034	160.7999	0.0000	0.0000	0.0000	0.0000	374.7026	660.0776	917.1385 (98)
Space heating												4682.4625 (98)
Space heating per m2												(98) / (4) = 56.4696 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1070.4351	842.6829	864.0857	0.0000	0.0000	0.0000	0.0000	(100)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8162	0.8831	0.8491	0.0000	0.0000	0.0000	0.0000	(101)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	873.7278	744.1751	733.6897	0.0000	0.0000	0.0000	0.0000	(102)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1100.5396	1052.1814	970.3156	0.0000	0.0000	0.0000	0.0000	(103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)	
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	163.3045	229.1567	176.0497	0.0000	0.0000	0.0000	0.0000	(104)	
Cooled fraction												568.5109	(104)	
Intermittency factor (Table 10b)												FC = cooled area / (4) =	1.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)	
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.8261	57.2892	44.0124	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling per m2												142.1277	(107)	
Energy for space heating												1.7140	(108)	
Energy for space cooling												56.4696	(99)	
Total												1.7140	(108)	
Dwelling Fabric Energy Efficiency (DFEE)												58.1837	(109)	
												58.2	(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	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					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) = 0.1444 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3944 (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) = 0.3353 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.4275	0.4191	0.4107	0.3688	0.3604	0.3185	0.3185	0.3101	0.3353	0.3604	0.3772	0.3939 (22b)
	0.5914	0.5878	0.5843	0.5680	0.5649	0.5507	0.5507	0.5481	0.5562	0.5649	0.5711	0.5776 (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 Semi-glazed door			2.1200	1.2000	2.5440		(26a)					
TER Opening Type (U _w = 1.40)			12.8200	1.3258	16.9962		(27)					
Heat Loss Floor 1			8.2500	0.1300	1.0725		(28a)					
Heat Loss Floor 2			31.1500	0.1300	4.0495		(28b)					
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398		(29a)					
Wall To Garage	13.7800		13.7800	0.1800	2.4804		(29a)					
External Roof 2	39.4000		39.4000	0.1300	5.1220		(30)					
Total net area of external elements A _{um} , m ²					196.6300		(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 48.3044		(33)					
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4717 (36)					
Total fabric heat loss							(33) + (36) = 62.7761 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.5349	40.2918	40.0534	38.9338	38.7243	37.7492	37.7492	37.5686	38.1248	38.7243	39.1481	39.5911 (38)
Average = Sum(39)m / 12 =	103.3111	103.0679	102.8295	101.7099	101.5005	100.5253	100.5253	100.3448	100.9009	101.5005	101.9242	102.3672 (39)
	101.7089 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2459	1.2430	1.2401	1.2266	1.2241	1.2123	1.2123	1.2101	1.2168	1.2241	1.2292	1.2345 (40)
Days in month												1.2266 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												
Average daily hot water use (litres/day)												
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy conte	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
Water 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 (46)
Total = Sum(45)m =	1478.2535 (45)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	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	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	0.0000 (59)
Heat gains from water heating, kWh/month	32.5684	28.4846	29.3935	25.6260	24.5887	21.2182	19.6618	22.5622	22.8317	26.6081	29.0448	31.5408	(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	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	125.7967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.1125	18.7519	15.2501	11.5453	8.6303	7.2860	7.8728	10.2334	13.7352	17.4400	20.3551	21.6993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.4349	227.7742	221.8792	209.3295	193.4877	178.5987	168.6519	166.3126	172.2076	184.7573	200.5991	215.4881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	35.5797	(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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	(71)
Water heating gains (Table 5)	43.7748	42.3878	39.5074	35.5916	33.0494	29.4697	26.4271	30.3255	31.7106	35.7636	40.3400	42.3935	(72)
Total internal gains	351.0612	349.6529	337.3758	317.2055	295.9064	276.0935	263.6909	267.6105	278.3925	298.6999	322.0332	340.3200	(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	8.2700	19.6403	0.6300	0.7000	0.7700	49.6392 (76)
South	0.6800	46.7521	0.6300	0.7000	0.7700	9.7159 (78)
West	3.8700	19.6403	0.6300	0.7000	0.7700	23.2290 (80)

Solar gains	82.5840	158.4577	255.0215	365.2808	443.4621	452.4987	431.3720	373.0597	294.2002	186.3050	102.3746	68.3186	(83)
Total gains	433.6452	508.1106	592.3972	682.4862	739.3685	728.5922	695.0629	640.6702	572.5926	485.0049	424.4078	408.6386	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7378	55.8693	55.9988	56.6153	56.7321	57.2824	57.2824	57.3855	57.0692	56.7321	56.4962	56.2517	
alpha	4.7159	4.7246	4.7333	4.7744	4.7821	4.8188	4.8188	4.8257	4.8046	4.7821	4.7664	4.7501	
util living area	0.9989	0.9974	0.9923	0.9724	0.9109	0.7729	0.6081	0.6719	0.8977	0.9867	0.9978	0.9992	(86)
MIT	19.5616	19.7163	19.9936	20.3666	20.6978	20.9102	20.9780	20.9651	20.7961	20.3552	19.8910	19.5371	(87)
Th 2	19.8834	19.8858	19.8880	19.8988	19.9008	19.9102	19.9102	19.9119	19.9065	19.9008	19.8967	19.8925	(88)
util rest of house	0.9985	0.9965	0.9894	0.9609	0.8722	0.6803	0.4715	0.5358	0.8371	0.9794	0.9968	0.9989	(89)
MIT 2	18.5733	18.7294	19.0071	19.3817	19.6912	19.8675	19.9045	19.9017	19.7873	19.3767	18.9128	18.5559	(90)
Living area fraction	fLA = Living area / (4) =												0.3268 (91)
MIT	18.8963	19.0520	19.3295	19.7036	20.0202	20.2083	20.2553	20.2492	20.1170	19.6965	19.2325	18.8766	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8963	19.0520	19.3295	19.7036	20.0202	20.2083	20.2553	20.2492	20.1170	19.6965	19.2325	18.8766	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	432.7788	505.8343	584.9440	654.0555	648.5046	515.9616	359.2256	372.1674	487.2908	474.1473	422.7002	408.0251	(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	1507.9610	1458.6134	1319.2509	1098.8338	844.5015	563.7713	367.4549	386.2489	607.1202	923.2942	1236.5948	1502.4049	(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	799.9356	640.2675	546.3243	320.2404	145.8217	0.0000	0.0000	0.0000	0.0000	334.1653	586.0041	814.2186	(98)
Space heating													4186.9776 (98)
Space heating per m2													(98) / (4) = 50.4942 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8286	0.8983	0.8671	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	783.0149	668.2068	661.2678	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	946.0749	904.9597	843.1107	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	117.4031	176.1442	135.2911	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													428.8385 (104)
Cooled fraction									fC = cooled area / (4) =				1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.3508	44.0361	33.8228	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													107.2096 (107)
Space cooling per m2													1.2929 (108)
Energy for space heating													50.4942 (99)
Energy for space cooling													1.2929 (108)
Total													51.7871 (109)
Target Fabric Energy Efficiency (TFEE)													59.6 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	5.0000	4.9000	4.3000	4.2000	3.9000	3.7000	3.5000	3.9000	4.2000	4.5000	4.7000 (22)
Wind factor	1.2500	1.2500	1.2250	1.0750	1.0500	0.9750	0.9250	0.8750	0.9750	1.0500	1.1250	1.1750 (22a)
Adj infilt rate	0.2656	0.2656	0.2603	0.2284	0.2231	0.2072	0.1966	0.1859	0.2072	0.2231	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5156	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2350		(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			18.0000	708.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19628.6200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							236.7176 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss						(33) + (36) =	76.1269 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	35.3435	35.3435	34.9793	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725 (38)
Heat transfer coeff	111.4703	111.4703	111.1062	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993 (39)
Average = Sum(39)m / 12 =												110.6367 (39)
HLP	1.3443	1.3443	1.3399	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314 (40)
HLP (average)												1.3343 (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	2.5159 (42)
Average daily hot water use (litres/day)	93.9534 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy cont	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)												Total = Sum(45)m = 1478.2535 (45)
Distribution loss (46)m = 0.15 x (45)m	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641 (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	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589 (61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (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	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918 (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	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0688	46.2471	37.6106	28.4737	21.2844	17.9692	19.4163	25.2381	33.8745	43.0115	50.2008	53.5160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.4700	339.9615	331.1630	312.4321	288.7876	266.5652	251.7193	248.2278	257.0262	275.7572	299.4016	321.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115 (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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374 (71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567 (72)
Total internal gains	580.0870	575.5163	552.9310	518.2926	482.8375	451.0552	432.8957	441.9693	462.2150	497.0680	535.7061	564.5269 (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	8.2700	18.2144	0.7600	0.7500	0.7700	59.5015 (76)						
South	0.6900	43.9264	0.7600	0.7500	0.7700	11.7989 (78)						
West	3.8700	18.2144	0.7600	0.7500	0.7700	27.8441 (80)						
Solar gains	99.1445	190.7455	320.9305	464.5394	559.9997	565.9194	538.4572	459.2736	365.4138	223.8003	116.9955	80.3978 (83)
Total gains	679.2315	766.2618	873.8615	982.8320	1042.8372	1016.9747	971.3529	901.2428	827.6288	720.8683	652.7015	644.9248 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	48.9134	48.9134	49.0737	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879 (85)
util living area	0.9925	0.9873	0.9721	0.9314	0.8444	0.7198	0.6170	0.6704	0.8455	0.9599	0.9879	0.9940 (86)
MIT	19.8544	19.9630	20.1898	20.4725	20.7170	20.8546	20.9018	20.8870	20.7608	20.4418	20.0986	19.8304 (87)
Th 2	19.8063	19.8063	19.8097	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163 (88)
util rest of house	0.9903	0.9835	0.9635	0.9101	0.7964	0.6363	0.5085	0.5632	0.7833	0.9434	0.9836	0.9922 (89)
MIT 2	18.2931	18.4504	18.7794	19.1815	19.5030	19.6609	19.7042	19.6937	19.5653	19.1479	18.6566	18.2658 (90)
Living area fraction									FLA = Living area / (4) =			0.3268 (91)
MIT	18.8034	18.9447	19.2403	19.6034	19.8998	20.0510	20.0956	20.0837	19.9560	19.5708	19.1279	18.7772 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6534	18.7947	19.0903	19.4534	19.7498	19.9010	19.9456	19.9337	19.8060	19.4208	18.9779	18.6272 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9873	0.9792	0.9569	0.9022	0.7933	0.6429	0.5211	0.5748	0.7826	0.9363	0.9794	0.9896 (94)
Useful gains	670.5846	750.3254	836.1559	886.6715	827.2609	653.7728	506.1853	518.0073	647.7290	674.9325	639.2861	638.2159 (95)
Ext temp.	3.6000	4.0000	5.5000	7.8000	10.7000	13.5000	15.2000	15.0000	12.8000	9.5000	6.3000	3.5000 (96)
Heat loss rate W	1678.0027	1649.1736	1509.9683	1286.5270	999.0911	706.6703	523.9098	544.6734	773.4599	1095.2492	1399.6289	1670.0294 (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	749.5191	604.0260	501.3164	287.8960	127.8417	0.0000	0.0000	0.0000	0.0000	312.7157	547.4468	767.6692 (98)
Space heating												3898.4308 (98)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

3898 (98)

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) = 0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.2350			(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			18.0000	708.8400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	19628.6200 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							236.7176 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss			(33) + (36) =	76.1269 (37)			

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	35.7076	35.3435	34.9793	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725 (38)
Heat transfer coeff	111.8345	111.4703	111.1062	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993 (39)
Average = Sum(39)m / 12 =												110.6671 (39)
HLP	1.3487	1.3443	1.3399	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314 (40)
HLP (average)												1.3346 (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	2.5159 (42)
Average daily hot water use (litres/day)	93.9534 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy cont	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)	Total = Sum (45)m = 1478.2535 (45)											
Distribution loss (46)m = 0.15 x (45)m	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641 (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	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589 (61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (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	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (64)
Total per year (kWh/year) = Sum (64)m =	2038.4067 (64)											
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918 (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	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0688	46.2471	37.6106	28.4737	21.2844	17.9692	19.4163	25.2381	33.8745	43.0115	50.2008	53.5160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.4700	339.9615	331.1630	312.4321	288.7876	266.5652	251.7193	248.2278	257.0262	275.7572	299.4016	321.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115 (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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374 (71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567 (72)
Total internal gains	580.0870	575.5163	552.9310	518.2926	482.8375	451.0552	432.8957	441.9693	462.2150	497.0680	535.7061	564.5269 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	8.2700	19.6403	0.7600	0.7500	0.7700	64.1595 (76)						
South	0.6800	46.7521	0.7600	0.7500	0.7700	12.5579 (78)						
West	3.8700	19.6403	0.7600	0.7500	0.7700	30.0238 (80)						
Solar gains	106.7413	204.8092	329.6196	472.1316	573.1823	584.8623	557.5557	482.1860	380.2587	240.8024	132.3210	88.3030 (83)
Total gains	686.8282	780.3256	882.5506	990.4242	1056.0198	1035.9175	990.4514	924.1552	842.4737	737.8705	668.0270	652.8299 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9909	0.9835	0.9639	0.9099	0.7995	0.6337	0.4784	0.5297	0.7681	0.9407	0.9839	0.9926 (86)
tau	48.7541	48.9134	49.0737	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879
alpha	4.2503	4.2609	4.2716	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925
MIT	19.9221	20.0581	20.2859	20.5644	20.7805	20.8940	20.9267	20.9212	20.8387	20.5478	20.1850	19.9026 (87)
Th 2	19.8029	19.8063	19.8097	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163 (88)
util rest of house	0.9881	0.9784	0.9524	0.8812	0.7392	0.5351	0.3557	0.4029	0.6796	0.9154	0.9779	0.9903 (89)
MIT 2	18.3892	18.5894	18.9169	19.3066	19.5790	19.6969	19.7204	19.7179	19.6505	19.2945	18.7816	18.3712 (90)
Living area fraction	18.8902	19.0687	19.3643	19.7177	19.9717	20.0881	20.1147	20.1112	20.0388	19.7041	19.2403	18.8717 (92)
Temperature adjustment	18.7402	18.9187	19.2143	19.5677	19.8217	19.9381	19.9647	19.9612	19.8888	19.5541	19.0903	-0.1500
adjusted MIT	18.7402	18.9187	19.2143	19.5677	19.8217	19.9381	19.9647	19.9612	19.8888	19.5541	19.0903	18.7217 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	676.2828	759.5212	834.0883	865.6375	780.9004	565.5621	367.9893	387.3257	577.7484	670.1446	649.9716	644.5775 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1614.9105	1562.6700	1412.6364	1177.7072	896.6266	589.3260	371.4558	393.1512	639.0805	988.5259	1323.7185	1603.1864 (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	698.3390	539.7161	430.4398	224.6902	86.1003	0.0000	0.0000	0.0000	0.0000	236.8757	485.0977	713.2050 (98)
Space heating	Space heating per m ²											
Space heating per m ²	(98) / (4) = 41.1778 (99)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													91.9000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3343.8710 (211)
Space heating requirement	698.3390	539.7161	430.4398	224.6902	86.1003	0.0000	0.0000	0.0000	0.0000	236.8757	485.0977	713.2050	(98)
Space heating efficiency (main heating system 1)	91.9000	91.9000	91.9000	91.9000	91.9000	0.0000	0.0000	0.0000	0.0000	91.9000	91.9000	91.9000	(210)
Space heating fuel (main heating system)	683.9011	528.5576	421.5406	220.0448	84.3202	0.0000	0.0000	0.0000	0.0000	231.9784	475.0685	698.4598	(211)
Water heating requirement	107.4368	83.0332	66.2215	34.5677	13.2462	0.0000	0.0000	0.0000	0.0000	36.4424	74.6304	109.7239	(215)
Water heating requirement	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	228.1812	200.9877	209.1147	185.4742	179.5718	158.1568	151.5262	168.9162	170.7817	194.4690	207.5919	222.7779	(219)
Water heating fuel used													2277.5494 (219)
Annual totals kWh/year													
Space heating fuel - main system													3343.8710 (211)
Space heating fuel - secondary													525.3021 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													46.6272 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													121.6272 (231)
Electricity for lighting (calculated in Appendix L)													367.8206 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.50 * 1080 * 1.00) =										-1295.4295			-1295.4295 (233)
Total delivered energy for all uses													5340.7407 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3343.8710	3.4800	116.3667 (240)
Space heating - secondary	525.3021	4.2300	22.2203 (242)
Water heating (other fuel)	2277.5494	3.4800	79.2587 (247)
Mechanical ventilation fans	46.6272	13.1900	6.1501 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	367.8206	13.1900	48.5155 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1295.4295	13.1900	-170.8672 (252)
Total energy cost			231.5367 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7602 (257)
SAP value		89.3951
SAP rating (Section 12)		89 (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	3343.8710	0.2160	722.2761 (261)
Space heating - secondary	525.3021	0.0190	9.9807 (263)
Water heating (other fuel)	2277.5494	0.2160	491.9507 (264)
Space and water heating			1224.2075 (265)
Pumps and fans	121.6272	0.5190	63.1245 (267)
Energy for lighting	367.8206	0.5190	190.8989 (268)
Energy saving/generation technologies			
PV Unit	-1295.4295	0.5190	-672.3279 (269)
Total kg/year			805.9030 (272)
CO2 emissions per m2			9.7200 (273)
EI value			91.5579

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating
EI band

92 (274)
A

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.8950 = 4.170$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.8950 = 0.2588$, stars = 4
Water heating energy efficiency	$3.48 / 0.8950 = 3.888$, stars = 4
Water heating environmental impact	$0.216 / 0.8950 = 0.2413$, stars = 4

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	5.0000	4.9000	4.3000	4.2000	3.9000	3.7000	3.5000	3.9000	4.2000	4.5000	4.7000 (22)
Wind factor	1.2500	1.2500	1.2250	1.0750	1.0500	0.9750	0.9250	0.8750	0.9750	1.0500	1.1250	1.1750 (22a)
Adj infilt rate	0.2656	0.2656	0.2603	0.2284	0.2231	0.2072	0.1966	0.1859	0.2072	0.2231	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5156	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2350		(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			18.0000	708.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19628.6200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							236.7176 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss						(33) + (36) =	76.1269 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	35.3435	35.3435	34.9793	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725 (38)
Heat transfer coeff	111.4703	111.4703	111.1062	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993 (39)
Average = Sum(39)m / 12 =												110.6367 (39)
HLP	1.3443	1.3443	1.3399	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314 (40)
HLP (average)												1.3343 (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	2.5159 (42)
Average daily hot water use (litres/day)	93.9534 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy content (annual)	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Distribution loss (46)m = 0.15 x (45)m												
Total = Sum(45)m =	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641 (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	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589 (61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (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	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (64)
Total per year (kWh/year) = Sum(64)m =	2038.4067 (64)											
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918 (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	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0688	46.2471	37.6106	28.4737	21.2844	17.9692	19.4163	25.2381	33.8745	43.0115	50.2008	53.5160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.4700	339.9615	331.1630	312.4321	288.7876	266.5652	251.7193	248.2278	257.0262	275.7572	299.4016	321.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115 (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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374 (71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567 (72)
Total internal gains	580.0870	575.5163	552.9310	518.2926	482.8375	451.0552	432.8957	441.9693	462.2150	497.0680	535.7061	564.5269 (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	8.2700	18.2144	0.7600	0.7500	0.7700	59.5015 (76)						
South	0.6800	43.9264	0.7600	0.7500	0.7700	11.7989 (78)						
West	3.8700	18.2144	0.7600	0.7500	0.7700	27.8441 (80)						
Solar gains	99.1445	190.7455	320.9305	464.5394	559.9997	565.9194	538.4572	459.2736	365.4138	223.8003	116.9955	80.3978 (83)
Total gains	679.2315	766.2618	873.8615	982.8320	1042.8372	1016.9747	971.3529	901.2428	827.6288	720.8683	652.7015	644.9248 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	48.9134	48.9134	49.0737	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879
alpha	4.2609	4.2609	4.2716	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925
util living area	0.9925	0.9873	0.9721	0.9314	0.8444	0.7198	0.6170	0.6704	0.8455	0.9599	0.9879	0.9940 (86)
MIT	19.8544	19.9630	20.1898	20.4725	20.7170	20.8546	20.9018	20.8870	20.7608	20.4418	20.0986	19.8304 (87)
Th 2	19.8063	19.8063	19.8097	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163 (88)
util rest of house	0.9903	0.9835	0.9635	0.9101	0.7964	0.6363	0.5085	0.5632	0.7833	0.9434	0.9836	0.9922 (89)
MIT 2	18.2931	18.4504	18.7794	19.1815	19.5030	19.6609	19.7042	19.6937	19.5653	19.1479	18.6566	18.2658 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8034	18.9447	19.2403	19.6034	19.8998	20.0510	20.0956	20.0837	19.9560	19.5708	19.1279	18.7772 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.6534	18.7947	19.0903	19.4534	19.7498	19.9010	19.9456	19.9337	19.8060	19.4208	18.9779	18.6272 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9873	0.9792	0.9569	0.9022	0.7933	0.6429	0.5211	0.5748	0.7826	0.9363	0.9794	0.9896 (94)
Useful gains	670.5846	750.3254	836.1559	886.6715	827.2609	653.7728	506.1853	518.0073	647.7290	674.9325	639.2861	638.2159 (95)
Ext temp.	3.6000	4.0000	5.5000	7.8000	10.7000	13.5000	15.2000	15.0000	12.8000	9.5000	6.3000	3.5000 (96)
Heat loss rate W	1678.0027	1649.1736	1509.9683	1286.5270	999.0911	706.6703	523.9098	544.6734	773.4599	1095.2492	1399.6289	1670.0294 (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	749.5191	604.0260	501.3164	287.8960	127.8417	0.0000	0.0000	0.0000	0.0000	312.7157	547.4468	767.6692 (98)
Space heating												3898.4308 (98)
Space heating per m2												(98) / (4) = 47.0144 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													91.9000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3817.8322 (211)
Space heating requirement	749.5191	604.0260	501.3164	287.8960	127.8417	0.0000	0.0000	0.0000	0.0000	312.7157	547.4468	767.6692	(98)
Space heating efficiency (main heating system 1)	91.9000	91.9000	91.9000	91.9000	91.9000	0.0000	0.0000	0.0000	0.0000	91.9000	91.9000	91.9000	(210)
Space heating fuel (main heating system)	734.0230	591.5380	490.9519	281.9438	125.1986	0.0000	0.0000	0.0000	0.0000	306.2504	536.1285	751.7979	(211)
Water heating requirement	115.3106	92.9271	77.1256	44.2917	19.6680	0.0000	0.0000	0.0000	0.0000	48.1101	84.2226	118.1030	(215)
Water heating requirement	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	228.1812	200.9877	209.1147	185.4742	179.5718	158.1568	151.5262	168.9162	170.7817	194.4690	207.5919	222.7779	(219)
Water heating fuel used													2277.5494 (219)
Annual totals kWh/year													
Space heating fuel - main system													3817.8322 (211)
Space heating fuel - secondary													599.7586 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													46.6272 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													121.6272 (231)
Electricity for lighting (calculated in Appendix L)													367.8206 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.50 * 1037 * 1.00) =										-1244.1879			-1244.1879 (233)
Total delivered energy for all uses													5940.4000 (238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3817.8322	3.6300	138.5873 (240)	
Space heating - secondary	599.7586	5.1600	30.9475 (242)	
Water heating (other fuel)	2277.5494	3.6300	82.6750 (247)	
Mechanical ventilation fans	46.6272	19.4400	9.0643 (249)	
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)	
Energy for lighting	367.8206	19.4400	71.5043 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1244.1879	19.4400	-241.8701 (252)	
Total energy cost			200.4884 (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	3817.8322	0.2160	824.6517 (261)	
Space heating - secondary	599.7586	0.0190	11.3954 (263)	
Water heating (other fuel)	2277.5494	0.2160	491.9507 (264)	
Space and water heating			1327.9978 (265)	
Pumps and fans	121.6272	0.5190	63.1245 (267)	
Energy for lighting	367.8206	0.5190	190.8989 (268)	
Energy saving/generation technologies				
PV Unit	-1244.1879	0.5190	-645.7335 (269)	
Total kg/year			936.2877 (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	3817.8322	1.2200	4657.7552 (261)	
Space heating - secondary	599.7586	1.0400	623.7489 (263)	
Water heating (other fuel)	2277.5494	1.2200	2778.6103 (264)	
Space and water heating			8060.1144 (265)	
Pumps and fans	121.6272	3.0700	373.3955 (267)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy for lighting	367.8206	3.0700	1129.2092 (268)
Energy saving/generation technologies			
PV Unit	-1244.1879	3.0700	-3819.6569 (269)
Primary energy kWh/year			5743.0623 (272)
Primary energy kWh/m ² /year			69.2603 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
 Current environmental impact rating: A 92

(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	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 24	-176 kg (18.8%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£24	2.12 kg/m ²	B 91	A 93
Total Savings	£24	2.12 kg/m²		

Potential energy efficiency rating: B 91
 Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, North East England):

	Current	Potential	Saving
Electricity	£95	£105	-£10
Mains gas	£316	£282	£34
Wood	£31	£31	£0
Space heating	£288	£288	£0
Water heating	£83	£58	£24
Lighting	£72	£72	£0
Generated (PV)	-£242	-£242	£0
Total cost of fuels	£200	£176	£24
Total cost of uses	£201	£176	£24
Delivered energy	72 kWh/m ²	61 kWh/m ²	11 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	69 kWh/m ²	57 kWh/m ²	12 kWh/m ²

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.7120 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2350		(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			18.0000	708.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19628.6200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							236.7176 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss						(33) + (36) =	76.1269 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	35.7076	35.3435	34.9793	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725 (38)
Heat transfer coeff	111.8345	111.4703	111.1062	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993 (39)
Average = Sum(39)m / 12 =												110.6671 (39)
HLP	1.3487	1.3443	1.3399	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314 (40)
HLP (average)												1.3346 (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	2.5159 (42)
Average daily hot water use (litres/day)	93.9534 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488	(44)
Energy content	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273	(45)
Energy content (annual)	Total = Sum(45)m =											1478.2535	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641	(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	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589	(61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862	(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												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2269	(H8)
Utilisation factor												0.5574	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												93.9534	(H14)
Volume ratio Veff/V												0.7983	(H15)
Solar storage volume factor												0.9549	(H16)
Solar input	-24.6143	-41.0742	-69.9540	-93.7522	-115.8229	-113.8723	-112.3675	-98.1760	-76.8915	-52.5079	-29.1961	-20.5980	(63)
Solar input (sum of months) = Sum(63)m =												-848.8268	(63)
Output from w/h	179.6079	138.8099	117.2037	72.2473	44.8938	27.6780	23.2485	53.0040	75.9581	121.5419	156.5986	178.7882	(64)
Total per year (kWh/year) = Sum(64)m =												1189.5799	(64)
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918	(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	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0688	46.2471	37.6106	28.4737	21.2844	17.9692	19.4163	25.2381	33.8745	43.0115	50.2008	53.5160	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.4700	339.9615	331.1630	312.4321	288.7876	266.5652	251.7193	248.2278	257.0262	275.7572	299.4016	321.6240	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	(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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	(71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567	(72)
Total internal gains	580.0870	575.5163	552.9310	518.2926	482.8375	451.0552	432.8957	441.9693	462.2150	497.0680	535.7061	564.5269	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	8.2700	19.6403	0.7600	0.7600	0.7500	0.7700	64.1595	(76)					
South	0.6800	46.7521	0.7600	0.7600	0.7500	0.7700	12.5579	(78)					
West	3.8700	19.6403	0.7600	0.7600	0.7500	0.7700	30.0238	(80)					
Solar gains	106.7413	204.8092	329.6196	472.1316	573.1823	584.8623	557.5557	482.1860	380.2587	240.8024	132.3210	88.3030	(83)
Total gains	686.8282	780.3256	882.5506	990.4242	1056.0198	1035.9175	990.4514	924.1552	842.4737	737.8705	668.0270	652.8299	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000	(85)
tau	48.7541	48.9134	49.0737	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	(87)	
alpha	4.2503	4.2609	4.2716	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	(88)	
util living area	0.9909	0.9835	0.9639	0.9099	0.7995	0.6337	0.4784	0.5297	0.7681	0.9407	0.9839	0.9926	(86)	
MIT	19.9221	20.0581	20.2859	20.5644	20.7805	20.8940	20.9267	20.9212	20.8387	20.5478	20.1850	19.9026	(87)	
Th 2	19.8029	19.8063	19.8097	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	(88)	
util rest of house	0.9881	0.9784	0.9524	0.8812	0.7392	0.5351	0.3557	0.4029	0.6796	0.9154	0.9779	0.9903	(89)	
MIT 2	18.3892	18.5884	18.9169	19.3066	19.5790	19.6969	19.7204	19.7179	19.6505	19.2945	18.7816	18.3712	(90)	
Living area fraction												fLA = Living area / (4) =	0.3268	(91)
MIT	18.8902	19.0687	19.3643	19.7177	19.9717	20.0881	20.1147	20.1112	20.0388	19.7041	19.2403	18.8717	(92)	
Temperature adjustment													-0.1500	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 18.7402 18.9187 19.2143 19.5677 19.8217 19.9381 19.9647 19.9612 19.8888 19.5541 19.0903 18.7217 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9846	0.9733	0.9451	0.8740	0.7395	0.5460	0.3715	0.4191	0.6858	0.9082	0.9730	0.9874	(94)
Useful gains	676.2828	759.5212	834.0883	865.6375	780.9004	565.5621	367.9893	387.3257	577.7484	670.1446	649.9716	644.5775	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1614.9105	1562.6700	1412.6364	1177.7072	896.6266	589.3260	371.4558	393.1512	639.0805	988.5259	1323.7185	1603.1864	(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	698.3390	539.7161	430.4398	224.6902	86.1003	0.0000	0.0000	0.0000	0.0000	236.8757	485.0977	713.2050	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 41.1778 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													91.9000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3343.8710 (211)
Space heating requirement	698.3390	539.7161	430.4398	224.6902	86.1003	0.0000	0.0000	0.0000	0.0000	236.8757	485.0977	713.2050	(98)
Space heating efficiency (main heating system 1)	91.9000	91.9000	91.9000	91.9000	91.9000	0.0000	0.0000	0.0000	0.0000	91.9000	91.9000	91.9000	(210)
Space heating fuel (main heating system)	683.9011	528.5576	421.5406	220.0448	84.3202	0.0000	0.0000	0.0000	0.0000	231.9784	475.0685	698.4598	(211)
Water heating requirement	107.4368	83.0332	66.2215	34.5677	13.2462	0.0000	0.0000	0.0000	0.0000	36.4424	74.6304	109.7239	(215)
Water heating requirement	179.6079	138.8099	117.2037	72.2473	44.8938	27.6780	23.2485	53.0040	75.9581	121.5419	156.5986	178.7882	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	200.6792	155.0948	130.9538	80.7232	50.1607	30.9251	25.9760	59.2224	84.8694	135.8010	174.9705	199.7634	(219)
Water heating fuel used													1329.1396 (219)
Annual totals kWh/year													
Space heating fuel - main system													3343.8710 (211)
Space heating fuel - secondary													525.3021 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840													
mechanical ventilation fans (SFP = 0.1840)													46.6272 (230a)
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													171.6272 (231)
Electricity for lighting (calculated in Appendix L)													367.8206 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.50 * 1080 * 1.00) =										-1295.4295			-1295.4295 (233)
Total delivered energy for all uses													4442.3309 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3343.8710	3.4800	116.3667	(240)
Space heating - secondary	525.3021	4.2300	22.2203	(242)
Water heating (other fuel)	1329.1396	3.4800	46.2541	(247)
Mechanical ventilation fans	46.6272	13.1900	6.1501	(249)
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	367.8206	13.1900	48.5155	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1295.4295	13.1900	-170.8672	(252)
Total energy cost			205.1271	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.6735	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	90.6048	
SAP rating (Section 12)		91	(258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	3343.8710	0.2160	722.2761 (261)
Space heating - secondary	525.3021	0.0190	9.9807 (263)
Water heating (other fuel)	1329.1396	0.2160	287.0942 (264)
Space and water heating			1019.3510 (265)
Pumps and fans	171.6272	0.5190	89.0745 (267)
Energy for lighting	367.8206	0.5190	190.8989 (268)
Energy saving/generation technologies			
PV Unit	-1295.4295	0.5190	-672.3279 (269)
Total kg/year			626.9965 (272)
CO2 emissions per m2			7.5600 (273)
EI value			93.4320
EI rating			93 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	8.2500 (1b)	x 2.6000 (2b)	= 21.4500 (1b) - (3b)
First floor	39.4000 (1c)	x 2.4000 (2c)	= 94.5600 (1c) - (3c)
Second floor	35.2700 (1d)	x 2.6000 (2d)	= 91.7020 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.7120 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (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) =	0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	5.0000	4.9000	4.3000	4.2000	3.9000	3.7000	3.5000	3.9000	4.2000	4.5000	4.7000 (22)
Wind factor	1.2500	1.2500	1.2250	1.0750	1.0500	0.9750	0.9250	0.8750	0.9750	1.0500	1.1250	1.1750 (22a)
Adj infilt rate	0.2656	0.2656	0.2603	0.2284	0.2231	0.2072	0.1966	0.1859	0.2072	0.2231	0.2391	0.2497 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5156	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Opening Type 1			2.1200	1.8000	3.8160		(26a)
Opening Type 2 (Uw = 1.60)			12.8200	1.5038	19.2782		(27)
Heat Loss Floor 1			8.2500	0.1400	1.1550	75.0000	618.7500 (28a)
Heat Loss Floor 2			31.1500	0.1838	5.7241	20.0000	623.0000 (28b)
External Wall 1	104.0500	14.9400	89.1100	0.1800	16.0398	110.0000	9802.1000 (29a)
Wall To Garage	13.7800		13.7800	0.1524	2.0999	110.0000	1515.8000 (29a)
External Roof 2	39.4000		39.4000	0.1300	5.1220	9.0000	354.6000 (30)
Total net area of external elements Aum(A, m2)			196.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.2350		(33)
Party Wall 1			65.8300	0.0000	0.0000	70.0000	4608.1000 (32)
Internal Wall 2			76.5100			9.0000	688.5900 (32c)
Internal Floor 1			39.3800			18.0000	708.8400 (32d)
Internal Ceiling 1			39.3800			18.0000	708.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19628.6200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							236.7176 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.8919 (36)
Total fabric heat loss						(33) + (36) =	76.1269 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	35.3435	35.3435	34.9793	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725	34.2725 (38)
Heat transfer coeff	111.4703	111.4703	111.1062	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993	110.3993 (39)
Average = Sum(39)m / 12 =												110.6367 (39)
HLP	1.3443	1.3443	1.3399	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314	1.3314 (40)
HLP (average)												1.3343 (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	2.5159 (42)
Average daily hot water use (litres/day)	93.9534 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.3488	99.5906	95.8325	92.0744	88.3162	84.5581	84.5581	88.3162	92.0744	95.8325	99.5906	103.3488 (44)
Energy conte	153.2633	134.0450	138.3225	120.5929	115.7117	99.8504	92.5261	106.1751	107.4431	125.2146	136.6815	148.4273 (45)
Energy content (annual)	Total = Sum(45)m = 1478.2535 (45)											
Distribution loss (46)m = 0.15 x (45)m	22.9895	20.1068	20.7484	18.0889	17.3568	14.9776	13.8789	15.9263	16.1165	18.7822	20.5022	22.2641 (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	50.9589	45.8390	48.8352	45.4065	45.0050	41.6999	43.0899	45.0050	45.4065	48.8352	49.1132	50.9589 (61)
Total heat required for water heating calculated for each month	204.2222	179.8840	187.1577	165.9994	160.7167	141.5503	135.6160	151.1800	152.8497	174.0498	185.7947	199.3862 (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	1036.8233 (H5)											
Overshading factor	0.8000 (H6)											
Solar energy available	1741.8631 (H7)											
Adjustment factor for showers	1.0000 (H7a)											
Solar-to-load ratio	1.1783 (H8)											
Utilisation factor	0.5720 (H9)											
Collector performance factor	0.8793 (H10)											
Dedicated solar storage volume	75.0000 (H11)											
Effective solar volume	75.0000 (H13)											
Daily hot water demand	93.9534 (H14)											
Volume ratio Veff/V	0.7983 (H15)											
Solar storage volume factor	0.9549 (H16)											
Solar input	-23.5319	-39.3646	-70.0468	-94.7906	-116.2123	-113.1301	-111.4310	-96.0657	-75.9667	-50.2083	-26.5691	-836.6210 (H17)
Solar input (sum of months) = Sum(63)m =	-836.6210 (63)											
Output from w/h	180.6902	140.5194	117.1109	71.2088	44.5044	28.4203	24.1849	55.1144	76.8829	123.8415	159.2256	180.0824 (64)
Total per year (kWh/year) = Sum(64)m =	1201.7857 (64)											
Heat gains from water heating, kWh/month	63.6998	56.0297	58.2010	51.4488	49.7254	43.6252	41.5374	46.5545	47.0765	53.8427	57.7249	62.0918 (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	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561	150.9561 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.0688	46.2471	37.6106	28.4737	21.2844	17.9692	19.4163	25.2381	33.8745	43.0115	50.2008	53.5160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	336.4700	339.9615	331.1630	312.4321	288.7876	266.5652	251.7193	248.2278	257.0262	275.7572	299.4016	321.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115	52.6115 (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)	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374	-100.6374 (71)
Water heating gains (Table 5)	85.6180	83.3776	78.2272	71.4566	66.8352	60.5906	55.8298	62.5732	65.3840	72.3692	80.1735	83.4567 (72)
Total internal gains	580.0870	575.5163	552.9310	518.2926	482.8375	451.0552	432.8957	441.9693	462.2150	497.0680	535.7061	564.5269 (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	8.2700	18.2144	0.7600	0.7500	0.7700	59.5015 (76)						
South	0.6800	43.9264	0.7600	0.7500	0.7700	11.7989 (78)						
West	3.8700	18.2144	0.7600	0.7500	0.7700	27.8441 (80)						
Solar gains	99.1445	190.7455	320.9305	464.5394	559.9997	565.9194	538.4572	459.2736	365.4138	223.8003	116.9955	80.3978 (83)
Total gains	679.2315	766.2618	873.8615	982.8320	1042.8372	1016.9747	971.3529	901.2428	827.6288	720.8683	652.7015	644.9248 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	21.0000 (85)											
tau	48.9134	48.9134	49.0737	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879	49.3879
alpha	4.2609	4.2609	4.2716	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925	4.2925
util living area	0.9925	0.9873	0.9721	0.9314	0.8444	0.7198	0.6170	0.6704	0.8455	0.9599	0.9879	0.9940 (86)
MIT	19.8544	19.9630	20.1898	20.4725	20.7170	20.8546	20.9018	20.8870	20.7608	20.4418	20.0986	19.8304 (87)
Th 2	19.8063	19.8063	19.8097	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163	19.8163 (88)
util rest of house	0.9903	0.9835	0.9635	0.9101	0.7964	0.6363	0.5085	0.5632	0.7833	0.9434	0.9836	0.9922 (89)
MIT 2	18.2931	18.4504	18.7794	19.1815	19.5030	19.6609	19.7042	19.6937	19.5653	19.1479	18.6566	18.2658 (90)
Living area fraction	fLA = Living area / (4) = 0.3268 (91)											
MIT	18.8034	18.9447	19.2403	19.6034	19.8998	20.0510	20.0956	20.0837	19.9560	19.5708	19.1279	18.7772 (92)
Temperature adjustment	-0.1500											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

adjusted MIT 18.6534 18.7947 19.0903 19.4534 19.7498 19.9010 19.9456 19.9337 19.8060 19.4208 18.9779 18.6272 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9792	0.9569	0.9022	0.7933	0.6429	0.5211	0.5748	0.7826	0.9363	0.9794	0.9896	(94)
Useful gains	670.5846	750.3254	836.1559	886.6715	827.2609	653.7728	506.1853	518.0073	647.7290	674.9325	639.2861	638.2159	(95)
Ext temp.	3.6000	4.0000	5.5000	7.8000	10.7000	13.5000	15.2000	15.0000	12.8000	9.5000	6.3000	3.5000	(96)
Heat loss rate W													
1678.0027	1649.1736	1509.9683	1286.5270	999.0911	706.6703	523.9098	544.6734	773.4599	1095.2492	1399.6289	1670.0294		(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													
749.5191	604.0260	501.3164	287.8960	127.8417	0.0000	0.0000	0.0000	0.0000	312.7157	547.4468	767.6692		(98)
Space heating													
Space heating per m2													(98) / (4) = 47.0144 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													91.9000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													3817.8322 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	749.5191	604.0260	501.3164	287.8960	127.8417	0.0000	0.0000	0.0000	0.0000	312.7157	547.4468	767.6692	(98)
Space heating efficiency (main heating system 1)	91.9000	91.9000	91.9000	91.9000	91.9000	0.0000	0.0000	0.0000	0.0000	91.9000	91.9000	91.9000	(210)
Space heating fuel (main heating system)	734.0230	591.5380	490.9519	281.9438	125.1986	0.0000	0.0000	0.0000	0.0000	306.2504	536.1285	751.7979	(211)
Water heating requirement	115.3106	92.9271	77.1256	44.2917	19.6680	0.0000	0.0000	0.0000	0.0000	48.1101	84.2226	118.1030	(215)
Water heating													
Water heating requirement	180.6902	140.5194	117.1109	71.2088	44.5044	28.4203	24.1849	55.1144	76.8829	123.8415	159.2256	180.0824	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	201.8885	157.0049	130.8502	79.5629	49.7256	31.7545	27.0223	61.5803	85.9027	138.3704	177.9057	201.2094	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													3817.8322 (211)
Space heating fuel - secondary													599.7586 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840													
mechanical ventilation fans (SFP = 0.1840)													46.6272 (230a)
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													171.6272 (231)
Electricity for lighting (calculated in Appendix L)													367.8206 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.50 * 1037 * 1.00) =													-1244.1879 (233)
Total delivered energy for all uses													5055.6280 (238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3817.8322	3.6300	138.5873	(240)
Space heating - secondary	599.7586	5.1600	30.9475	(242)
Water heating (other fuel)	1342.7774	3.6300	48.7428	(247)
Mechanical ventilation fans	46.6272	19.4400	9.0643	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	367.8206	19.4400	71.5043	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1244.1879	19.4400	-241.8701	(252)
Total energy cost			176.2762	(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	3817.8322	0.2160	824.6517	(261)
Space heating - secondary	599.7586	0.0190	11.3954	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Water heating (other fuel)	1342.7774	0.2160	290.0399 (264)
Space and water heating			1126.0871 (265)
Pumps and fans	171.6272	0.5190	89.0745 (267)
Energy for lighting	367.8206	0.5190	190.8989 (268)
Energy saving/generation technologies			
PV Unit	-1244.1879	0.5190	-645.7335 (269)
Total kg/year			760.3269 (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	3817.8322	1.2200	4657.7552 (261)
Space heating - secondary	599.7586	1.0400	623.7489 (263)
Water heating (other fuel)	1342.7774	1.2200	1638.1884 (264)
Space and water heating			6919.6925 (265)
Pumps and fans	171.6272	3.0700	526.8955 (267)
Energy for lighting	367.8206	3.0700	1129.2092 (268)
Energy saving/generation technologies			
PV Unit	-1244.1879	3.0700	-3819.6569 (269)
Primary energy kWh/year			4756.1404 (272)
Primary energy kWh/m2/year			57.3582 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	No
SAP Region	North East England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	236.7 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.50 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	171.36 (P1)
Transmission heat loss coefficient	76.13 (37)
Summer heat loss coefficient	247.49 (P2)

Overhangs

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

Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
East	0.800	0.90	1.000	0.720 (P8)
South	0.800	0.90	1.000	0.720 (P8)
West	0.800	0.90	1.000	0.720 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	8.2700	111.2086	0.7600	0.7500	0.7200	339.6986
South	0.6800	110.4126	0.7600	0.7500	0.7200	27.7318
West	3.8700	111.2086	0.7600	0.7500	0.7200	158.9641

total: 526.3945

	Jun	Jul	Aug
Solar gains	544	526	450 (P3)
Internal gains	448	430	439
Total summer gains	992	956	889 (P5)
Summer gain/loss ratio	4.01	3.86	3.59 (P6)
Summer external temperature	13.80	15.80	15.60
Thermal mass temperature increment (TMP = 236.7)	0.34	0.34	0.34
Threshold temperature	18.15	20.01	19.54 (P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant

Assessment of likelihood of high internal temperature: Not significant