

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BD23 6RR Plot 31		Issued on Date	20/07/2022	
Assessment Reference	001	Prop Type Ref	Type A1		
Property	Plot 31, Phase 4, Shires Lane, Embsay, Skipton, BD23 6RR				
SAP Rating	96 A	DER	2.97	TER	20.57
Environmental	99 A	% DER<TER	85.56		
CO₂ Emissions (t/year)	0.14	DFEE	47.76	TFEE	52.33
General Requirements Compliance	Pass	% DFEE<TFEE	8.73		
Assessor Details	Mr. Jake Eaton, Jake Eaton, Tel: 01400283471, jake@eratech.co.uk		Assessor ID	P711-0001	
Client					

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

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DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 54 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) 20.57 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 2.97 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.8 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	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof (no roof)			
Openings	1.65 (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 North: 2.40 m², No overhang
Windows facing South: 4.69 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 2.00 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	53.9100 (1b)	x 2.4800 (2b)	= 133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6968 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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)			7.0900	1.5038	10.6617		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083	75.0000	4043.2500 (28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534	110.0000	5899.3000 (29a)
Total net area of external elements Aum(A, m2)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.1394		(33)
Party Wall 1			13.4900	0.0000	0.0000	70.0000	944.3000 (32)
Party Ceilings 1			53.9100			40.0000	2156.4000 (32b)
Internal Wall 2			35.2200			9.0000	316.9800 (32c)
Internal Wall 1			33.7300			75.0000	2529.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15889.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							294.7501 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4496 (36)
Total fabric heat loss						(33) + (36) =	41.5890 (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
(38)m	22.9837	22.7493	22.5150	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600 (38)
Heat transfer coeff	64.5727	64.3383	64.1039	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489 (39)
Average = Sum(39)m / 12 =												63.8213 (39)
HLP	1.1978	1.1934	1.1891	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807 (40)
HLP (average)												1.1838 (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												1.8054 (42)
Average daily hot water use (litres/day)												77.0772 (43)
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)										Total = Sum(45)m =		1212.7247 (45)

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Distribution loss (46)m = 0.15 x (45)m	18.8600	16.4951	17.0215	14.8397	14.2391	12.2872	11.3859	13.0655	13.2216	15.4085	16.8196	18.2649 (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	43.2055	37.6052	40.0633	37.2505	36.9210	34.2096	35.3499	36.9210	37.2505	40.0633	40.2913	43.2055 (61)
Total heat required for water heating calculated for each month	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (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	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (64)
Heat gains from water heating, kWh/month	52.6078	45.9655	47.7468	42.2074	40.7936	35.7891	34.0763	38.1922	38.6204	44.1713	47.3562	51.2887 (65)
												1675.0613 (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	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.0303	13.3498	10.8568	8.2193	6.1440	5.1870	5.6048	7.2853	9.7783	12.4158	14.4910	15.4480 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.3723	159.0053	154.8901	146.1294	135.0705	124.6767	117.7330	116.1000	120.2152	128.9759	140.0348	150.4286 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268 (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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143 (71)
Water heating gains (Table 5)	70.7094	68.4010	64.1758	58.6213	54.8301	49.7071	45.8015	51.3336	53.6395	59.3700	65.7725	68.9364 (72)
Total internal gains	296.1923	293.8364	283.0030	266.0503	249.1249	232.6512	222.2196	227.7992	236.7133	253.8420	273.3786	287.8933 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	2.4000	10.6334	0.7600	0.7500	0.7700	10.0807 (74)
South	4.6900	46.7521	0.7600	0.7500	0.7700	86.6127 (78)
Solar gains	96.6934	161.1141	213.4264	256.8016	283.6421	280.6286
Total gains	392.8857	454.9505	496.4294	522.8519	532.7670	513.2798
						493.1174
						270.8977
						250.4942
						228.1117
						175.9300
						115.1015
						83.2451 (83)
						371.1385 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	68.3553	68.6043	68.8551	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473
alpha	5.5570	5.5736	5.5903	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232
util living area	0.9977	0.9943	0.9858	0.9606	0.8899	0.7367	0.5575	0.5965	0.8239	0.9672	0.9945	0.9983 (86)
MIT	20.1714	20.2880	20.4507	20.6465	20.8175	20.9184	20.9458	20.9431	20.8876	20.6712	20.3840	20.1557 (87)
Th 2	19.9218	19.9253	19.9287	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355 (88)
util rest of house	0.9968	0.9920	0.9800	0.9434	0.8420	0.6382	0.4284	0.4669	0.7403	0.9493	0.9919	0.9976 (89)
MIT 2	18.8234	18.9958	19.2338	19.5158	19.7386	19.8446	19.8629	19.8618	19.8191	19.5541	19.1447	18.8116 (90)
Living area fraction	19.4123	19.5603	19.7654	20.0097	20.2099	20.3137	20.3360	20.3342	20.2859	20.0421	19.6860	19.3987 (92)
Temperature adjustment	19.2623	19.4103	19.6154	19.8597	20.0599	20.1637	20.1860	20.1842	20.1359	19.8921	19.5360	-0.1500
adjusted MIT												19.2487 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9960	0.9906	0.9778	0.9419	0.8485	0.6609	0.4596	0.4982	0.7580	0.9484	0.9906	0.9970 (94)
Ext temp.	391.3110	450.6680	485.3955	492.4651	452.0431	339.2278	226.6225	238.3076	352.3367	407.5878	384.8323	370.0366 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	966.1535	933.5652	840.7506	697.5758	532.0995	354.1220	228.2440	240.8600	384.1787	591.4297	791.5411	957.8362 (97)
Space heating kWh	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 per m2	427.6828	324.5070	264.3842	147.6797	59.5620	0.0000	0.0000	0.0000	0.0000	136.7784	292.8303	437.3228 (98)
												2090.7472 (98)
												38.7822 (99)

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

	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 %)													89.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													2102.4273 (211)
Space heating requirement	427.6828	324.5070	264.3842	147.6797	59.5620	0.0000	0.0000	0.0000	0.0000	136.7784	292.8303	437.3228	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	430.0721	326.3198	265.8612	148.5048	59.8947	0.0000	0.0000	0.0000	0.0000	137.5425	294.4662	439.7660	(211)
Water heating requirement	65.7974	49.9241	40.6745	22.7200	9.1634	0.0000	0.0000	0.0000	0.0000	21.0428	45.0508	67.2804	(215)
Water heating requirement	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718	(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	188.7588	164.8856	171.5528	152.1587	147.3165	129.7481	124.3086	138.5750	140.1054	159.5379	170.3035	184.3260	(219)
Water heating fuel used													1871.5769 (219)
Annual totals kWh/year													
Space heating fuel - main system													2102.4273 (211)
Space heating fuel - secondary													321.6534 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													30.0123 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													105.0123 (231)
Electricity for lighting (calculated in Appendix L)													265.4396 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.00 * 1080 * 1.00) =													-1727.2394 (233)
Total delivered energy for all uses													2938.8700 (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	2102.4273	0.2160	454.1243	(261)
Space heating - secondary	321.6534	0.0190	6.1114	(263)
Water heating (other fuel)	1871.5769	0.2160	404.2606	(264)
Space and water heating			864.4963	(265)
Pumps and fans	105.0123	0.5190	54.5014	(267)
Energy for lighting	265.4396	0.5190	137.7631	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total CO2, kg/year			160.3236	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			2.9700	(273)

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

DER			2.9700	ZC1
Total Floor Area		TFA	53.9100	
Assumed number of occupants		N	1.8054	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.2984	ZC2
CO2 emissions from cooking, equation (L16)			3.0111	ZC3
Total CO2 emissions			23.2795	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			23.2795	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.9100 (1b)	2.4800 (2b)	133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.6968 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (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) =				20.0000 / (5) =	0.1496 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3996 (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) =	0.3397 (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	0.4331	0.4246	0.4161	0.3736	0.3651	0.3227	0.3227	0.3142	0.3397	0.3651	0.3821	0.3991 (22b)
Effective ac	0.5938	0.5901	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5796 (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 (Uw = 1.40)			7.0900	1.3258	9.3996		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083		(28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534		(29a)
Total net area of external elements Aum(A, m ²)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.6053	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6547 (36)
Total fabric heat loss						(33) + (36) =	37.2600 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.1971	26.0364	25.8790	25.1393	25.0010	24.3568	24.3568	24.2375	24.6049	25.0010	25.2809	25.5736 (38)
Heat transfer coeff	63.4571	63.2965	63.1390	62.3994	62.2610	61.6168	61.6168	61.4975	61.8649	62.2610	62.5409	62.8336 (39)
Average = Sum(39)m / 12 =												62.3987 (39)
HLP	1.1771	1.1741	1.1712	1.1575	1.1549	1.1430	1.1430	1.1407	1.1476	1.1549	1.1601	1.1655 (40)
HLP (average)												1.1575 (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												1.8054 (42)
Average daily hot water use (litres/day)												77.0772 (43)
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)												Total = Sum(45)m = 1212.7247 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8600	16.4951	17.0215	14.8397	14.2391	12.2872	11.3859	13.0655	13.2216	15.4085	16.8196	18.2649 (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	43.2055	37.6052	40.0633	37.2505	36.9210	34.2096	35.3499	36.9210	37.2505	40.0633	40.2913	43.2055 (61)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718	(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	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718	(64)
Heat gains from water heating, kWh/month	52.6078	45.9655	47.7468	42.2074	40.7936	35.7891	34.0763	38.1922	38.6204	44.1713	47.3562	51.2887	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2595	13.5534	11.0223	8.3446	6.2377	5.2661	5.6902	7.3964	9.9274	12.6051	14.7120	15.6836	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.3723	159.0053	154.8901	146.1294	135.0705	124.6767	117.7330	116.1000	120.2152	128.9759	140.0348	150.4286	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	(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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	(71)
Water heating gains (Table 5)	70.7094	68.4010	64.1758	58.6213	54.8301	49.7071	45.8015	51.3336	53.6395	59.3700	65.7725	68.9364	(72)
Total internal gains	296.4215	294.0400	283.1685	266.1757	249.2186	232.7303	222.3051	227.9103	236.8624	254.0314	273.5996	288.1289	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
North	2.4000	10.6334	0.6300	0.7000	0.7700	7.7993 (74)							
South	4.6900	46.7521	0.6300	0.7000	0.7700	67.0109 (78)							
Solar gains	74.8102	124.6514	165.1246	198.6833	219.4494	217.1179	209.5893	193.8034	176.4864	136.1143	89.0522	64.4055	(83)
Total gains	371.2317	418.6914	448.2932	464.8590	468.6680	449.8482	431.8944	421.7137	413.3488	390.1456	362.6518	352.5344	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	58.9965	59.1463	59.2938	59.9966	60.1300	60.7586	60.7586	60.8765	60.5149	60.1300	59.8608	59.5820	
alpha	4.9331	4.9431	4.9529	4.9998	5.0087	5.0506	5.0506	5.0584	5.0343	5.0087	4.9907	4.9721	
util living area	0.9963	0.9927	0.9849	0.9640	0.9081	0.7754	0.6041	0.6386	0.8474	0.9670	0.9925	0.9971	(86)
MIT	19.8041	19.9534	20.1775	20.4661	20.7330	20.9205	20.9822	20.9763	20.8665	20.5296	20.1143	19.7769	(87)
Th 2	19.9384	19.9408	19.9431	19.9542	19.9562	19.9659	19.9659	19.9677	19.9622	19.9562	19.9521	19.9477	(88)
util rest of house	0.9951	0.9903	0.9796	0.9500	0.8696	0.6863	0.4740	0.5109	0.7754	0.9513	0.9896	0.9962	(89)
MIT 2	18.3567	18.5755	18.9019	19.3218	19.6848	19.9100	19.9590	19.9576	19.8545	19.4173	18.8189	18.3236	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.9890	19.1774	19.4591	19.8217	20.1427	20.3514	20.4060	20.4026	20.2966	19.9032	19.3848	18.9585	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9890	19.1774	19.4591	19.8217	20.1427	20.3514	20.4060	20.4026	20.2966	19.9032	19.3848	18.9585	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	368.8411	413.6276	437.7051	440.5925	411.2607	324.8683	229.4830	239.1563	331.2355	370.7435	358.0832	350.7463
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	932.1188	903.7103	818.2248	681.5063	525.6485	354.3836	234.5129	246.1524	383.3530	579.2285	768.3016	927.3282
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
Space heating kWh	419.0787	329.3355	283.1066	173.4580	85.1045	0.0000	0.0000	0.0000	0.0000	155.1128	295.3573	428.9769
Space heating												2169.5303 (98)
Space heating per m2												40.2436 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2322.8376 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	419.0787	329.3355	283.1066	173.4580	85.1045	0.0000	0.0000	0.0000	0.0000	155.1128	295.3573	428.9769	(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)	448.6924	352.6076	303.1120	185.7152	91.1183	0.0000	0.0000	0.0000	0.0000	166.0737	316.2283	459.2901	(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	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718	(64)
Efficiency of water heater	87.2472	87.0134	86.5711	85.6614	83.9806	80.3000	80.3000	80.3000	80.3000	85.2599	86.6885	87.3484	(216)
Fuel for water heating, kWh/month	193.6327	169.5976	177.3568	158.9772	156.9985	144.6134	138.5507	154.4515	156.1573	167.4718	175.8269	188.8663	(219)
Water heating fuel used													1982.5007 (219)
Annual totals kWh/year													
Space heating fuel - main system													2322.8376 (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)													269.4876 (232)
Total delivered energy for all uses													4649.8259 (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	2322.8376	0.2160	501.7329 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1982.5007	0.2160	428.2201 (264)
Space and water heating			929.9531 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	269.4876	0.5190	139.8641 (268)
Total CO2, kg/m2/year			1108.7421 (272)
Emissions per m2 for space and water heating			17.2501 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5944 (272b)
Emissions per m2 for pumps and fans			0.7220 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.2501 * 1.00) + 2.5944 + 0.7220, rounded to 2 d.p.			20.5700 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	53.9100 (1b)	x 2.4800 (2b)	= 133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6968 (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					2 * 10 = 20.0000 (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 20.0000 / (5) = 0.1496 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3996 (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) =	0.3397 (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	0.4331	0.4246	0.4161	0.3736	0.3651	0.3227	0.3227	0.3142	0.3397	0.3651	0.3821	0.3991 (22b)
Effective ac	0.5938	0.5901	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5796 (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)			7.0900	1.5038	10.6617		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083	75.0000	4043.2500 (28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534	110.0000	5899.3000 (29a)
Total net area of external elements Aum(A, m2)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.1394		(33)
Party Wall 1			13.4900	0.0000	0.0000	70.0000	944.3000 (32)
Party Ceilings 1			53.9100			30.0000	1617.3000 (32b)
Internal Wall 2			35.2200			9.0000	316.9800 (32c)
Internal Wall 1			33.7300			75.0000	2529.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15350.8800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							284.7501 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4496 (36)
Total fabric heat loss						(33) + (36) =	41.5890 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.1971	26.0364	25.8790	25.1393	25.0010	24.3568	24.3568	24.2375	24.6049	25.0010	25.2809	25.5736 (38)
Heat transfer coeff	67.7860	67.6254	67.4679	66.7283	66.5899	65.9457	65.9457	65.8264	66.1939	66.5899	66.8699	67.1625 (39)
Average = Sum(39)m / 12 =												66.7276 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2574	1.2544	1.2515	1.2378	1.2352	1.2233	1.2233	1.2210	1.2279	1.2352	1.2404	1.2458 (40)
HLP (average)												1.2378 (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												1.8054 (42)
Average daily hot water use (litres/day)												77.0772 (43)
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)												Total = Sum(45)m = 1212.7247 (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:												



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF 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	26.7184	23.3681	24.1138	21.0230	20.1720	17.4069	16.1301	18.5095	18.7306	21.8287	23.8277	25.8753	(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	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.0303	13.3498	10.8568	8.2193	6.1440	5.1870	5.6048	7.2853	9.7783	12.4158	14.4910	15.4480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.3723	159.0053	154.8901	146.1294	135.0705	124.6767	117.7330	116.1000	120.2152	128.9759	140.0348	150.4286	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	(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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	(71)
Water heating gains (Table 5)	35.9118	34.7739	32.4110	29.1986	27.1129	24.1763	21.6802	24.8784	26.0147	29.3396	33.0940	34.7787	(72)
Total internal gains	258.3947	257.2093	248.2382	233.6275	218.4078	204.1204	195.0983	198.3440	206.0885	220.8117	237.7002	250.7356	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	2.4000	10.6334	0.7600	0.7500	0.7700	10.0807 (74)							
South	4.6900	46.7521	0.7600	0.7500	0.7700	86.6127 (78)							
Solar gains	96.6934	161.1141	213.4264	256.8016	283.6421	280.6286	270.8977	250.4942	228.1117	175.9300	115.1015	83.2451	(83)
Total gains	355.0881	418.3234	461.6646	490.4291	502.0499	484.7489	465.9961	448.8382	434.2002	396.7417	352.8017	333.9808	(84)

7. Mean internal temperature (heating season)

Temperatures 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)	62.9058	63.0552	63.2024	63.9029	64.0357	64.6612	64.6612	64.7784	64.4189	64.0357	63.7676	63.4898	21.0000 (85)
alpha	5.1937	5.2037	5.2135	5.2602	5.2690	5.3107	5.3107	5.3186	5.2946	5.2690	5.2512	5.2327	
util living area	0.9983	0.9957	0.9894	0.9702	0.9144	0.7781	0.6027	0.6451	0.8616	0.9766	0.9962	0.9988	(86)
MIT	19.8007	19.9626	20.1948	20.4869	20.7520	20.9304	20.9856	20.9794	20.8720	20.5278	20.1060	19.7719	(87)
Th 2	19.8744	19.8767	19.8790	19.8899	19.8919	19.9014	19.9014	19.9032	19.8978	19.8919	19.8878	19.8835	(88)
util rest of house	0.9977	0.9941	0.9849	0.9566	0.8732	0.6806	0.4628	0.5064	0.7850	0.9632	0.9944	0.9983	(89)
MIT 2	18.7924	18.9555	19.1875	19.4811	19.7261	19.8709	19.8983	19.8981	19.8313	19.5257	19.1078	18.7710	(90)
Living area fraction										fLA = Living area / (4) =		0.4368	(91)
MIT	19.2329	19.3955	19.6275	19.9205	20.1743	20.3337	20.3732	20.3705	20.2859	19.9634	19.5438	19.2082	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2329	19.3955	19.6275	19.9205	20.1743	20.3337	20.3732	20.3705	20.2859	19.9634	19.5438	19.2082	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9931	0.9837	0.9571	0.8853	0.7221	0.5249	0.5681	0.8155	0.9643	0.9936	0.9979	(94)
Useful gains	354.0870	415.4553	454.1326	469.3662	444.4555	350.0242	244.6056	255.0006	354.0785	382.5821	350.5468	333.2904	(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	1012.2406	980.2614	885.6858	735.3774	564.3010	378.1147	248.8283	261.3618	409.4674	623.5102	832.1182	1007.9900	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	489.6663	379.5497	321.0756	191.5281	89.1651	0.0000	0.0000	0.0000	0.0000	179.2505	346.7314	501.9765	(98)
Space heating												2498.9431	(98)
Space heating per m2												(98) / (4) =	46.3540 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	619.8899	487.9984	500.2809	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8515	0.9199	0.9038	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	527.8259	448.8860	452.1649	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	634.9805	611.7914	592.9052	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	77.1513	121.2016	104.7108	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			303.0637 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	19.2878	30.3004	26.1777	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												75.7659 (107)
Energy for space heating												1.4054 (108)
Energy for space cooling												46.3540 (99)
Total												1.4054 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.7594 (109)
												47.8 (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	53.9100 (1b)	2.4800 (2b)	133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.6968 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour	
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)	
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)	
Number of intermittent fans				2 * 10 =	20.0000 (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) =					20.0000 / (5) =	0.1496 (8)
Pressure test					Yes	
Measured/design AP50					5.0000	
Infiltration rate					0.3996	(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) =	0.3397 (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	0.4331	0.4246	0.4161	0.3736	0.3651	0.3227	0.3227	0.3142	0.3397	0.3651	0.3821	0.3991 (22b)
Effective ac	0.5938	0.5901	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5796 (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 (Uw = 1.40)			7.0900	1.3258	9.3996		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083		(28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534		(29a)
Total net area of external elements Aum(A, m ²)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.6053		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6547 (36)
Total fabric heat loss						(33) + (36) =	37.2600 (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	26.1971	26.0364	25.8790	25.1393	25.0010	24.3568	24.3568	24.2375	24.6049	25.0010	25.2809	25.5736 (38)
Heat transfer coeff	63.4571	63.2965	63.1390	62.3994	62.2610	61.6168	61.6168	61.4975	61.8649	62.2610	62.5409	62.8336 (39)
Average = Sum(39)m / 12 =												62.3987 (39)
HLP	1.1771	1.1741	1.1712	1.1575	1.1549	1.1430	1.1430	1.1407	1.1476	1.1549	1.1601	1.1655 (40)
HLP (average)												1.1575 (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												1.8054 (42)
Average daily hot water use (litres/day)												77.0772 (43)
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)												Total = Sum(45)m = 1212.7247 (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)
												0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
 26.7184 23.3681 24.1138 21.0230 20.1720 17.4069 16.1301 18.5095 18.7306 21.8287 23.8277 25.8753 (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	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678	90.2678 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2595	13.5534	11.0223	8.3446	6.2377	5.2661	5.6902	7.3964	9.9274	12.6051	14.7120	15.6836 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	157.3723	159.0053	154.8901	146.1294	135.0705	124.6767	117.7330	116.1000	120.2152	128.9759	140.0348	150.4286 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268	32.0268 (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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143 (71)
Water heating gains (Table 5)	35.9118	34.7739	32.4110	29.1986	27.1129	24.1763	21.6802	24.8784	26.0147	29.3396	33.0940	34.7787 (72)
Total internal gains	258.6239	257.4129	248.4037	233.7529	218.5015	204.1995	195.1838	198.4551	206.2376	221.0010	237.9212	250.9712 (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						
North	2.4000	10.6334	0.6300	0.7000	0.7700	7.7993 (74)						
South	4.6900	46.7521	0.6300	0.7000	0.7700	67.0109 (78)						
Solar gains	74.8102	124.6514	165.1246	198.6833	219.4494	217.1179	209.5893	193.8034	176.4864	136.1143	89.0522	64.4055 (83)
Total gains	333.4341	382.0643	413.5284	432.4362	437.9509	421.3174	404.7731	392.2585	382.7240	357.1153	326.9734	315.3767 (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	58.9965	59.1463	59.2938	59.9966	60.1300	60.7586	60.7586	60.8765	60.5149	60.1300	59.8608	59.5820
alpha	4.9331	4.9431	4.9529	4.9998	5.0087	5.0506	5.0506	5.0584	5.0343	5.0087	4.9907	4.9721
util living area	0.9977	0.9951	0.9892	0.9727	0.9260	0.8059	0.6377	0.6765	0.8763	0.9766	0.9952	0.9983 (86)
MIT	19.7396	19.8919	20.1211	20.4182	20.6981	20.9044	20.9774	20.9694	20.8405	20.4800	20.0542	19.7131 (87)
Th 2	19.9384	19.9408	19.9431	19.9542	19.9562	19.9659	19.9659	19.9677	19.9622	19.9562	19.9521	19.9477 (88)
util rest of house	0.9969	0.9934	0.9852	0.9615	0.8926	0.7202	0.5037	0.5459	0.8110	0.9648	0.9933	0.9977 (89)
MIT 2	18.7943	18.9478	19.1772	19.4775	19.7420	19.9185	19.9598	19.9585	19.8711	19.5420	19.1191	18.7754 (90)
Living area fraction	fLA = Living area / (4) =											0.4368 (91)
MIT	19.2073	19.3602	19.5895	19.8885	20.1596	20.3492	20.4043	20.4001	20.2946	19.9518	19.5276	19.1850 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2073	19.3602	19.5895	19.8885	20.1596	20.3492	20.4043	20.4001	20.2946	19.9518	19.5276	19.1850 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9962	0.9922	0.9835	0.9607	0.9002	0.7550	0.5631	0.6037	0.8348	0.9647	0.9923	0.9971 (94)
Useful gains	332.1720	379.0830	406.7232	415.4291	394.2452	318.0923	227.9196	236.7940	319.5094	344.5129	324.4432	314.4637 (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	945.9716	915.2803	826.4593	685.6736	526.7048	354.2455	234.4088	245.9971	383.2278	582.2496	777.2346	941.5631 (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	456.6669	360.3246	312.2836	194.5760	98.5500	0.0000	0.0000	0.0000	0.0000	176.8761	326.0098	466.5619 (98)
Space heating												2391.8490 (98)
Space heating per m2												(98) / (4) = 44.3674 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	579.1979	455.9643	467.3810	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8211	0.8968	0.8807	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	475.5672	408.9202	411.6168	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	560.9450	540.3459	526.9210	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	61.4720	97.7807	85.7864	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												245.0390 (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)

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	15.3680	24.4452	21.4466	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													61.2598 (107)
Space cooling per m2													1.1363 (108)
Energy for space heating													44.3674 (99)
Energy for space cooling													1.1363 (108)
Total													45.5038 (109)
Target Fabric Energy Efficiency (TFEE)													52.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	53.9100 (1b)	x 2.4800 (2b)	= 133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6968 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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)			7.0900	1.5038	10.6617		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083	75.0000	4043.2500 (28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534	110.0000	5899.3000 (29a)
Total net area of external elements Aum(A, m2)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.1394		(33)
Party Wall 1			13.4900	0.0000	0.0000	70.0000	944.3000 (32)
Party Ceilings 1			53.9100			40.0000	2156.4000 (32b)
Internal Wall 2			35.2200			9.0000	316.9800 (32c)
Internal Wall 1			33.7300			75.0000	2529.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15889.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							294.7501 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4496 (36)
Total fabric heat loss						(33) + (36) =	41.5890 (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
(38)m	22.7493	22.7493	22.5150	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600 (38)
Heat transfer coeff	64.3383	64.3383	64.1039	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489 (39)
Average = Sum(39)m / 12 =												63.8017 (39)
HLP	1.1934	1.1934	1.1891	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807 (40)
HLP (average)												1.1835 (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												1.8054 (42)
Average daily hot water use (litres/day)												77.0772 (43)
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)										Total = Sum(45)m =		1212.7247 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	18.8600	16.4951	17.0215	14.8397	14.2391	12.2872	11.3859	13.0655	13.2216	15.4085	16.8196	18.2649 (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	43.2055	37.6052	40.0633	37.2505	36.9210	34.2096	35.3499	36.9210	37.2505	40.0633	40.2913	43.2055 (61)
Total heat required for water heating calculated for each month	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (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	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (64)
RHI water heating demand												1675.0613 (64)
Heat gains from water heating, kWh/month	52.6078	45.9655	47.7468	42.2074	40.7936	35.7891	34.0763	38.1922	38.6204	44.1713	47.3562	51.2887 (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	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.5757	33.3744	27.1419	20.5482	15.3600	12.9676	14.0119	18.2132	24.4457	31.0395	36.2276	38.6201 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.8840	237.3213	231.1793	218.1035	201.5977	186.0846	175.7209	173.2836	179.4256	192.5014	209.0072	224.5203 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375 (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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143 (71)
Water heating gains (Table 5)	70.7094	68.4010	64.1758	58.6213	54.8301	49.7071	45.8015	51.3336	53.6395	59.3700	65.7725	68.9364 (72)
Total internal gains	429.9137	425.8414	409.2415	384.0176	358.5324	335.5039	322.2790	329.5750	344.2555	369.6554	397.7519	418.8213 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		2.4000	9.8938	0.7600	0.7500	0.7700	9.3796 (74)					
South		4.6900	43.9264	0.7600	0.7500	0.7700	81.3778 (78)					
Solar gains	90.7574	151.6860	209.9246	254.6282	278.5166	272.5649	262.7499	240.1670	221.2720	165.2795	102.8586	76.5755 (83)
Total gains	520.6711	577.5274	619.1661	638.6458	637.0490	608.0689	585.0289	569.7420	565.5275	534.9349	500.6104	495.3968 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.6043	68.6043	68.8551	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473
alpha	5.5736	5.5736	5.5903	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232
util living area	0.9924	0.9864	0.9720	0.9387	0.8609	0.7309	0.6127	0.6452	0.8130	0.9472	0.9860	0.9941	0.9941 (86)
MIT	20.2661	20.3555	20.5057	20.6776	20.8296	20.9141	20.9394	20.9354	20.8809	20.6951	20.4482	20.2439	20.2439 (87)
Th 2	19.9253	19.9253	19.9287	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355 (88)
util rest of house	0.9899	0.9817	0.9623	0.9170	0.8129	0.6479	0.5091	0.5425	0.7429	0.9243	0.9803	0.9921	0.9921 (89)
MIT 2	18.9632	19.0919	19.3092	19.5531	19.7480	19.8386	19.8588	19.8563	19.8080	19.5815	19.2356	18.9394	18.9394 (90)
Living area fraction										FLA = Living area / (4) =			0.4368 (91)
MIT	19.5323	19.6439	19.8319	20.0443	20.2205	20.3085	20.3309	20.3277	20.2766	20.0680	19.7653	19.5093	19.5093 (92)
Temperature adjustment													-0.1500
adjusted MIT	19.3823	19.4939	19.6819	19.8943	20.0705	20.1585	20.1809	20.1777	20.1266	19.9180	19.6153	19.3593	19.3593 (93)

8. Space heating requirement

Utilisation	0.9881	0.9794	0.9595	0.9160	0.8197	0.6664	0.5338	0.5669	0.7568	0.9239	0.9781	0.9906	0.9906 (94)
Useful gains	514.4634	565.6040	594.1062	585.0135	522.1777	405.2383	312.3123	322.9834	427.9906	494.2148	489.6617	490.7459	490.7459 (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	3.5000 (96)
Heat loss rate W	1015.4085	996.8510	909.1134	769.7910	596.4211	423.8035	317.0265	329.5541	466.3332	663.0931	847.5026	1009.4268	1009.4268 (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	1.0000 (97a)
Space heating kWh	372.7031	289.7980	234.3654	133.0398	55.2371	0.0000	0.0000	0.0000	0.0000	125.6455	257.6455	385.8985	385.8985 (98)
Space heating													1854.3329 (98)
RHI space heating demand													1854 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.9100 (1b)	x 2.4800 (2b)	= 133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6968 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour	
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)	
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)	
Number of intermittent fans				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												
If mechanical ventilation:												
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 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)			7.0900	1.5038	10.6617		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083	75.0000	4043.2500 (28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534	110.0000	5899.3000 (29a)
Total net area of external elements Aum(A, m ²)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	31.1394			(33)
Party Wall 1			13.4900	0.0000	0.0000	70.0000	944.3000 (32)
Party Ceilings 1			53.9100			40.0000	2156.4000 (32b)
Internal Wall 2			35.2200			9.0000	316.9800 (32c)
Internal Wall 1			33.7300			75.0000	2529.7500 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15889.9800			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				294.7501			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.4496			(36)
Total fabric heat loss			(33) + (36) =	41.5890			(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
(38)m	22.9837	22.7493	22.5150	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600 (38)
Heat transfer coeff	64.5727	64.3383	64.1039	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489 (39)
Average = Sum(39)m / 12 =	63.8213 (39)											
HLP	1.1978	1.1934	1.1891	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807 (40)
HLP (average)	1.1838 (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	1.8054 (42)											
Average daily hot water use (litres/day)	77.0772 (43)											
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)	Total = Sum(45)m = 1212.7247 (45)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	18.8600	16.4951	17.0215	14.8397	14.2391	12.2872	11.3859	13.0655	13.2216	15.4085	16.8196	18.2649 (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	43.2055	37.6052	40.0633	37.2505	36.9210	34.2096	35.3499	36.9210	37.2505	40.0633	40.2913	43.2055 (61)
Total heat required for water heating calculated for each month	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (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	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (64)
Heat gains from water heating, kWh/month	52.6078	45.9655	47.7468	42.2074	40.7936	35.7891	34.0763	38.1922	38.6204	44.1713	47.3562	51.2887 (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	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.5757	33.3744	27.1419	20.5482	15.3600	12.9676	14.0119	18.2132	24.4457	31.0395	36.2276	38.6201 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.8840	237.3213	231.1793	218.1035	201.5977	186.0846	175.7209	173.2836	179.4256	192.5014	209.0072	224.5203 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375 (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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143 (71)
Water heating gains (Table 5)	70.7094	68.4010	64.1758	58.6213	54.8301	49.7071	45.8015	51.3336	53.6395	59.3700	65.7725	68.9364 (72)
Total internal gains	429.9137	425.8414	409.2415	384.0176	358.5324	335.5039	322.2790	329.5750	344.2555	369.6554	397.7519	418.8213 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	2.4000	10.6334	0.7600	0.7500	0.7700	10.0807 (74)						
South	4.6900	46.7521	0.7600	0.7500	0.7700	86.6127 (78)						
Solar gains	96.6934	161.1141	213.4264	256.8016	283.6421	280.6286	270.8977	250.4942	228.1117	175.9300	115.1015	83.2451 (83)
Total gains	526.6071	586.9555	622.6679	640.8192	642.1745	616.1325	593.1767	580.0692	572.3672	545.5854	512.8533	502.0665 (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	68.3553	68.6043	68.8551	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473
alpha	5.5570	5.5736	5.5903	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232
util living area	0.9904	0.9813	0.9621	0.9152	0.8124	0.6378	0.4684	0.4993	0.7186	0.9179	0.9799	0.9924 (86)
MIT	20.3186	20.4285	20.5755	20.7424	20.8717	20.9353	20.9492	20.9481	20.9199	20.7681	20.5163	20.3012 (87)
Th 2	19.9218	19.9253	19.9287	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355 (88)
util rest of house	0.9869	0.9747	0.9487	0.8851	0.7515	0.5423	0.3572	0.3868	0.6277	0.8828	0.9715	0.9896 (89)
MIT 2	19.0365	19.1969	19.4075	19.6391	19.7953	19.8556	19.8640	19.8636	19.8444	19.6769	19.3330	19.0228 (90)
Living area fraction	19.5966	19.7349	19.9178	20.1211	20.2655	20.3273	20.3381	20.3374	20.3143	20.1536	19.8499	19.5812 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4466	19.5849	19.7678	19.9711	20.1155	20.1773	20.1881	20.1874	20.1643	20.0036	19.6999	19.4312 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9849	0.9721	0.9462	0.8862	0.7627	0.5649	0.3839	0.4138	0.6485	0.8854	0.9692	0.9879 (94)
Ext temp.	518.6796	570.5825	589.1969	567.9188	489.8149	348.0310	227.7193	240.0474	371.1809	483.0570	497.0713	496.0046 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	978.0557	944.8013	850.5147	704.6636	535.6384	354.9860	228.3759	241.0608	385.9835	598.5286	801.9733	969.4522 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	341.7758	251.4750	194.4205	98.4563	34.0927	0.0000	0.0000	0.0000	0.0000	85.9109	219.5294	352.2450 (98)
												1577.9057 (98)
												(98) / (4) = 29.2693 (99)

8c. Space cooling requirement

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													89.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													1586.7208 (211)
Space heating requirement	341.7758	251.4750	194.4205	98.4563	34.0927	0.0000	0.0000	0.0000	0.0000	85.9109	219.5294	352.2450	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	343.6852	252.8799	195.5066	99.0063	34.2832	0.0000	0.0000	0.0000	0.0000	86.3909	220.7559	354.2128	(211)
Water heating requirement	52.5809	38.6885	29.9108	15.1471	5.2450	0.0000	0.0000	0.0000	0.0000	13.2171	33.7738	54.1915	(215)
Water heating requirement	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718	(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	188.7588	164.8856	171.5528	152.1587	147.3165	129.7481	124.3086	138.5750	140.1054	159.5379	170.3035	184.3260	(219)
Water heating fuel used													1871.5769 (219)
Annual totals kWh/year													
Space heating fuel - main system													1586.7208 (211)
Space heating fuel - secondary													242.7547 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840													
mechanical ventilation fans (SFP = 0.1840)													30.0123 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													105.0123 (231)
Electricity for lighting (calculated in Appendix L)													265.4396 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.00 * 1080 * 1.00) =													-1727.2394 (233)
Total delivered energy for all uses													2344.2648 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1586.7208	3.4800	55.2179 (240)
Space heating - secondary	242.7547	4.2300	10.2685 (242)
Water heating (other fuel)	1871.5769	3.4800	65.1309 (247)
Mechanical ventilation fans	30.0123	13.1900	3.9586 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	265.4396	13.1900	35.0115 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			71.6570 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3043 (257)
SAP value		95.7553
SAP rating (Section 12)		96 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1586.7208	0.2160	342.7317 (261)
Space heating - secondary	242.7547	0.0190	4.6123 (263)
Water heating (other fuel)	1871.5769	0.2160	404.2606 (264)
Space and water heating			751.6046 (265)
Pumps and fans	105.0123	0.5190	54.5014 (267)
Energy for lighting	265.4396	0.5190	137.7631 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			47.4319 (272)
CO2 emissions per m2			0.8800 (273)
EI value			99.3574
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	53.9100 (1b)	x 2.4800 (2b)	= 133.6968 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.6968 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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)			7.0900	1.5038	10.6617		(27)
Heat Loss Floor 1			53.9100	0.1300	7.0083	75.0000	4043.2500 (28a)
External Wall 1	62.8400	9.2100	53.6300	0.1800	9.6534	110.0000	5899.3000 (29a)
Total net area of external elements Aum(A, m2)			116.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.1394		(33)
Party Wall 1			13.4900	0.0000	0.0000	70.0000	944.3000 (32)
Party Ceilings 1			53.9100			40.0000	2156.4000 (32b)
Internal Wall 2			35.2200			9.0000	316.9800 (32c)
Internal Wall 1			33.7300			75.0000	2529.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15889.9800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							294.7501 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4496 (36)
Total fabric heat loss						(33) + (36) =	41.5890 (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
(38)m	22.7493	22.7493	22.5150	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600	22.0600 (38)
Heat transfer coeff	64.3383	64.3383	64.1039	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489	63.6489 (39)
Average = Sum(39)m / 12 =												63.8017 (39)
HLP	1.1934	1.1934	1.1891	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807	1.1807 (40)
HLP (average)												1.1835 (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												1.8054 (42)
Average daily hot water use (litres/day)												77.0772 (43)
Daily hot water use	84.7849	81.7018	78.6188	75.5357	72.4526	69.3695	69.3695	72.4526	75.5357	78.6188	81.7018	84.7849 (44)
Energy conte	125.7336	109.9674	113.4765	98.9316	94.9272	81.9150	75.9063	87.1035	88.1438	102.7231	112.1303	121.7663 (45)
Energy content (annual)										Total = Sum(45)m =		1212.7247 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	18.8600	16.4951	17.0215	14.8397	14.2391	12.2872	11.3859	13.0655	13.2216	15.4085	16.8196	18.2649 (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	43.2055	37.6052	40.0633	37.2505	36.9210	34.2096	35.3499	36.9210	37.2505	40.0633	40.2913	43.2055 (61)
Total heat required for water heating calculated for each month	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (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	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718 (64)
Heat gains from water heating, kWh/month	52.6078	45.9655	47.7468	42.2074	40.7936	35.7891	34.0763	38.1922	38.6204	44.1713	47.3562	51.2887 (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	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214	108.3214 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.5757	33.3744	27.1419	20.5482	15.3600	12.9676	14.0119	18.2132	24.4457	31.0395	36.2276	38.6201 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.8840	237.3213	231.1793	218.1035	201.5977	186.0846	175.7209	173.2836	179.4256	192.5014	209.0072	224.5203 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375	47.6375 (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)	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143	-72.2143 (71)
Water heating gains (Table 5)	70.7094	68.4010	64.1758	58.6213	54.8301	49.7071	45.8015	51.3336	53.6395	59.3700	65.7725	68.9364 (72)
Total internal gains	429.9137	425.8414	409.2415	384.0176	358.5324	335.5039	322.2790	329.5750	344.2555	369.6554	397.7519	418.8213 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		2.4000	9.8938	0.7600	0.7500	0.7700	9.3796 (74)					
South		4.6900	43.9264	0.7600	0.7500	0.7700	81.3778 (78)					
Solar gains	90.7574	151.6860	209.9246	254.6282	278.5166	272.5649	262.7499	240.1670	221.2720	165.2795	102.8586	76.5755 (83)
Total gains	520.6711	577.5274	619.1661	638.6458	637.0490	608.0689	585.0289	569.7420	565.5275	534.9349	500.6104	495.3968 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	68.6043	68.6043	68.8551	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473	69.3473
alpha	5.5736	5.5736	5.5903	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232	5.6232
util living area	0.9924	0.9864	0.9720	0.9387	0.8609	0.7309	0.6127	0.6452	0.8130	0.9472	0.9860	0.9941 (86)
MIT	20.2661	20.3555	20.5057	20.6776	20.8296	20.9141	20.9394	20.9354	20.8809	20.6951	20.4482	20.2439 (87)
Th 2	19.9253	19.9253	19.9287	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355	19.9355 (88)
util rest of house	0.9898	0.9817	0.9623	0.9170	0.8129	0.6479	0.5091	0.5425	0.7429	0.9243	0.9803	0.9921 (89)
MIT 2	18.9632	19.0919	19.3092	19.5531	19.7480	19.8386	19.8588	19.8563	19.8080	19.5815	19.2356	18.9394 (90)
Living area fraction	19.5323	19.6439	19.8319	20.0443	20.2205	20.3085	20.3309	20.3277	20.2766	20.0680	19.7653	19.5093 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3823	19.4939	19.6819	19.8943	20.0705	20.1585	20.1809	20.1777	20.1266	19.9180	19.6153	19.3593 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9881	0.9794	0.9595	0.9160	0.8197	0.6664	0.5338	0.5669	0.7568	0.9239	0.9781	0.9906 (94)
Ext temp.	514.4634	565.6040	594.1062	585.0135	522.1777	405.2383	312.3123	322.9834	427.9906	494.2148	489.6617	490.7459 (95)
Heat loss rate W	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)
Month fracti	1015.4085	996.8510	909.1134	769.7910	596.4211	423.8035	317.0265	329.5541	466.3332	663.0931	847.5026	1009.4268 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	372.7031	289.7980	234.3654	133.0398	55.2371	0.0000	0.0000	0.0000	0.0000	125.6455	257.6455	385.8985 (98)
												1854.3329 (98)
												(98) / (4) = 34.3968 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Not applicable

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

	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 %)													89.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													1864.6923 (211)
Space heating requirement	372.7031	289.7980	234.3654	133.0398	55.2371	0.0000	0.0000	0.0000	0.0000	125.6455	257.6455	385.8985	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	374.7853	291.4170	235.6747	133.7831	55.5457	0.0000	0.0000	0.0000	0.0000	126.3474	259.0848	388.0544	(211)
Water heating requirement	57.3389	44.5843	36.0562	20.4677	8.4980	0.0000	0.0000	0.0000	0.0000	19.3301	39.6378	59.3690	(215)
Water heating requirement	168.9391	147.5727	153.5398	136.1821	131.8483	116.1246	111.2562	124.0246	125.3943	142.7864	152.4217	164.9718	(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	188.7588	164.8856	171.5528	152.1587	147.3165	129.7481	124.3086	138.5750	140.1054	159.5379	170.3035	184.3260	(219)
Water heating fuel used													1871.5769 (219)
Annual totals kWh/year													
Space heating fuel - main system													1864.6923 (211)
Space heating fuel - secondary													285.2820 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840													
mechanical ventilation fans (SFP = 0.1840)													30.0123 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													105.0123 (231)
Electricity for lighting (calculated in Appendix L)													265.4396 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.00 * 1037 * 1.00) =										-1658.9172			-1658.9172 (233)
Total delivered energy for all uses													2733.0857 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1864.6923	3.6300	67.6883 (240)
Space heating - secondary	285.2820	5.1600	14.7206 (242)
Water heating (other fuel)	1871.5769	3.6300	67.9382 (247)
Mechanical ventilation fans	30.0123	19.4400	5.8344 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	265.4396	19.4400	51.6015 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1658.9172	19.4400	-322.4935 (252)
Total energy cost			-5.1306 (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	1864.6923	0.2160	402.7735 (261)
Space heating - secondary	285.2820	0.0190	5.4204 (263)
Water heating (other fuel)	1871.5769	0.2160	404.2606 (264)
Space and water heating			812.4545 (265)
Pumps and fans	105.0123	0.5190	54.5014 (267)
Energy for lighting	265.4396	0.5190	137.7631 (268)
Energy saving/generation technologies			
PV Unit	-1658.9172	0.5190	-860.9780 (269)
Total kg/year			143.7410 (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	1864.6923	1.2200	2274.9246 (261)
Space heating - secondary	285.2820	1.0400	296.6933 (263)
Water heating (other fuel)	1871.5769	1.2200	2283.3238 (264)
Space and water heating			4854.9416 (265)
Pumps and fans	105.0123	3.0700	322.3876 (267)
Energy for lighting	265.4396	3.0700	814.8995 (268)
Energy saving/generation technologies			
PV Unit	-1658.9172	3.0700	-5092.8758 (269)
Primary energy kWh/year			899.3529 (272)
Primary energy kWh/m2/year			16.6825 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

 SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 96
 Current environmental impact rating: A 99

(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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
	Total Savings £0		0.00 kg/m ²

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 99

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	£72	£72	£0
Mains gas	£231	£231	£0
Wood	£15	£15	£0
Space heating	£198	£198	£0
Water heating	£68	£68	£0
Lighting	£52	£52	£0
Generated (PV)	-£322	-£322	£0
Total cost of fuels	-£4	-£4	£0
Total cost of uses	-£4	-£4	£0
Delivered energy	51 kWh/m ²	51 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.1 tonnes	0.1 tonnes	0.0 tonnes
CO2 emissions per m ²	3 kg/m ²	3 kg/m ²	0 kg/m ²
Primary energy	17 kWh/m ²	17 kWh/m ²	0 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

No improvements selected / applicable

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Maisonette
Number of storeys	1
Cross ventilation possible	No
SAP Region	North East England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	294.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	88.24 (P1)
Transmission heat loss coefficient	41.59 (37)
Summer heat loss coefficient	129.83 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.800	0.90	1.000	0.720 (P8)
South	0.800	0.90	1.000	0.720 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.4000	74.6426	0.7600	0.7500	0.7200	66.1680
South	4.6900	110.4126	0.7600	0.7500	0.7200	191.2676
total:						257.4356

	Jun	Jul	Aug	
Solar gains	262	257	236	(P3)
Internal gains	333	319	327	
Total summer gains	595	577	563	(P5)
Summer gain/loss ratio	4.58	4.44	4.34	(P6)
Summer external temperature	13.80	15.80	15.60	
Thermal mass temperature increment (TMP = 294.8)	0.00	0.00	0.00	
Threshold temperature	18.38	20.24	19.94	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			