

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-010			Issued on Date	12/02/2020
Assessment Reference	010	Prop Type Ref	3FF Semi		
Property	Plot 010, 1 Bed, K, Ba, Welwyn Garden City				
SAP Rating	83 B	DER	18.62	TER	21.07
Environmental	89 B	% DER<TER	11.62		
CO₂ Emissions (t/year)	0.76	DFEE	44.06	TFEE	52.38
General Requirements Compliance	Pass	% DFEE<TFEE	15.87		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client	TW North Thames, Taylor Wimpey				

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

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DWELLING AS DESIGNED

Top-floor flat, total floor area 47 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) 21.07 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.62 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.09 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (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: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1900 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (East Anglia): Slight OK

Based on:

Overshading: Average
Windows facing North East: 3.99 m², No overhang
Windows facing North West: 3.79 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.08 W/m²K
Door U-value 1.08 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	2.3700 (2b)	111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		111.1767 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 111.1767 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				2	2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (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	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.4500	7.7800	22.6700	0.2500	5.6675	52.8000	1196.9760 (29a)
External Wall to Corridor	3.3700	2.1200	1.2500	0.2200	0.2750	52.8000	66.0000 (29a)
External Wall to Stairwell	11.1900		11.1900	0.2000	2.2380	52.8000	590.8320 (29a)
Plane Ceiling	43.8600		43.8600	0.0800	3.5088	9.0000	394.7400 (30)
Sloping Ceiling	3.3200		3.3200	0.2000	0.6640	9.0000	29.8800 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			92.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0593		(33)
AAC Party Wall			21.6500	0.0000	0.0000	52.8000	1143.1200 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7729.7380 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.7780 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9836 (36)
Total fabric heat loss						(33) + (36) =	31.0429 (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	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442 (38)
Average = Sum(39)m / 12 =	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871 (39)
HLP	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528 (40)
HLP (average)												1.0528 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m = 1135.8629 (45)											
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1299.8227 (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	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.8590	11.4213	9.2884	7.0319	5.2564	4.4377	4.7951	6.2329	8.3657	10.6222	12.3977	13.2164 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	259.3982	257.7324	248.4888	233.7659	219.1449	204.8207	195.3731	200.0606	207.5032	222.3910	239.4616	251.9499 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Northwest	1.2700	11.2829	0.4300	0.0000	0.7700	4.7444 (81)						
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)						
Solar gains	29.0644	59.1614	106.5900	175.0514	235.3035	250.8584	234.6729	187.0839	129.8816	72.2999	36.5705	23.7354 (83)
Total gains	288.4625	316.8937	355.0788	408.8174	454.4484	455.6791	430.0460	387.1446	337.3848	294.6909	276.0321	275.6854 (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	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759
alpha	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984
util living area	0.9891	0.9832	0.9662	0.9148	0.8001	0.6324	0.4872	0.5541	0.7998	0.9477	0.9827	0.9909 (86)
MIT	19.4849	19.6418	19.9523	20.3720	20.7312	20.9216	20.9781	20.9644	20.8008	20.3418	19.8337	19.4369 (87)
Th 2	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396 (88)
util rest of house	0.9867	0.9794	0.9584	0.8947	0.7550	0.5562	0.3885	0.4515	0.7368	0.9312	0.9781	0.9888 (89)
MIT 2	18.0127	18.2405	18.6887	19.2810	19.7567	19.9770	20.0281	20.0192	19.8555	19.2506	18.5214	17.9430 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.6398	18.8374	19.2269	19.7457	20.1717	20.3793	20.4328	20.4218	20.2581	19.7154	19.0803	18.5792 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6398	18.8374	19.2269	19.7457	20.1717	20.3793	20.4328	20.4218	20.2581	19.7154	19.0803	18.5792 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9819	0.9732	0.9500	0.8875	0.7617	0.5843	0.4299	0.4938	0.7526	0.9243	0.9720	0.9846 (94)
Useful gains	283.2428	308.3914	337.3218	362.8100	346.1638	266.2737	184.8860	191.1684	253.9318	272.3794	268.3102	271.4268 (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	708.1985	688.3250	628.5425	535.6373	418.3937	285.4250	189.2886	198.6233	304.1309	450.1819	591.6738	710.1489 (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	316.1670	255.3154	216.6683	124.4356	53.7390	0.0000	0.0000	0.0000	0.0000	132.2851	232.8217	326.4093 (98)
Space heating												1657.8414 (98)
Space heating per m2												(98) / (4) = 35.3409 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 93.5000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 1773.0924 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	316.1670	255.3154	216.6683	124.4356	53.7390	0.0000	0.0000	0.0000	0.0000	132.2851	232.8217	326.4093	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	338.1465	273.0646	231.7308	133.0862	57.4749	0.0000	0.0000	0.0000	0.0000	141.4813	249.0072	349.1008	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.5347	89.4777	89.3314	88.9984	88.3726	87.3000	87.3000	87.3000	87.3000	89.0176	89.3946	87.3000	(216)
Fuel for water heating, kWh/month	147.1449	129.2078	134.5874	119.2511	116.3393	103.2711	97.3228	109.3613	109.9774	123.7275	132.5911	142.9224	(219)
Water heating fuel used												1465.7040	(219)
Annual totals kWh/year													
Space heating fuel - main system												1773.0924	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420
 mechanical ventilation fans (SFP = 0.2420) 32.8303 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 107.8303 (231)
 Electricity for lighting (calculated in Appendix L) 227.0943 (232)
 Total delivered energy for all uses 3573.7210 (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	1773.0924	0.2160	382.9880	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1465.7040	0.2160	316.5921	(264)
Space and water heating			699.5800	(265)
Pumps and fans	107.8303	0.5190	55.9639	(267)
Energy for lighting	227.0943	0.5190	117.8619	(268)
Total CO2, kg/year			873.4059	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.6200	(273)

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

DER		18.6200	ZC1
Total Floor Area	TFA	46.9100	
Assumed number of occupants	N	1.5997	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.5861	ZC2
CO2 emissions from cooking, equation (L16)		3.3552	ZC3
Total CO2 emissions		39.5613	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		39.5613	ZC8

FULL SAP CALCULATION PRINTOUT

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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	46.9100 (1b)	2.3700 (2b)	111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		111.1767 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 111.1767 (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) =	0.1799 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4299 (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) =	0.3654 (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	0.4659	0.4568	0.4476	0.4020	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4111	0.4294 (22b)
Effective ac	0.6085	0.6043	0.6002	0.5808	0.5772	0.5603	0.5603	0.5571	0.5668	0.5772	0.5845	0.5922 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.7800	1.3258	10.3144		(27)
External Wall	30.4500	7.7800	22.6700	0.1800	4.0806		(29a)
External Wall to Corridor	3.3700	2.1200	1.2500	0.1800	0.2250		(29a)
External Wall to Stairwell	11.1900		11.1900	0.1800	2.0142		(29a)
Plane Ceiling	43.8600		43.8600	0.1300	5.7018		(30)
Sloping Ceiling	3.3200		3.3200	0.1300	0.4316		(30)
Dormer roof	0.5100		0.5100	0.1300	0.0663		(30)
Total net area of external elements Aum(A, m ²)			92.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 24.9539		(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)							5.6541 (36)
Total fabric heat loss						(33) + (36) =	30.6080 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.3259	22.1713	22.0198	21.3079	21.1747	20.5547	20.5547	20.4399	20.7935	21.1747	21.4442	21.7258 (38)
Heat transfer coeff	52.9339	52.7793	52.6278	51.9159	51.7827	51.1627	51.1627	51.0479	51.4015	51.7827	52.0522	52.3338 (39)
Average = Sum(39)m / 12 =												51.9153 (39)
HLP	1.1284	1.1251	1.1219	1.1067	1.1039	1.0907	1.0907	1.0882	1.0957	1.1039	1.1096	1.1156 (40)
HLP (average)												1.1067 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)										Total = Sum(45)m =		1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
Combi loss	40.4671	35.2218	37.5241	34.8896	34.5810	32.0414	33.1095	34.5810	34.8896	37.5241	37.7377	40.4671	40.4671	40.4671	(61)
Total heat required for water heating calculated for each month	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	154.5159	154.5159	(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	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	154.5159	154.5159	(64)
Heat gains from water heating, kWh/month	49.2735	43.0522	44.7206	39.5323	38.2081	33.5208	31.9166	35.7716	36.1727	41.3717	44.3548	48.0380	48.0380	48.0380	(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	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.8590	11.4213	9.2884	7.0319	5.2564	4.4377	4.7951	6.2329	8.3657	10.6222	12.3977	13.2164	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	(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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	(71)
Water heating gains (Table 5)	66.2279	64.0658	60.1083	54.9060	51.3550	46.5567	42.8986	48.0801	50.2399	55.6071	61.6038	64.5672	(72)
Total internal gains	268.2981	266.1428	256.4121	241.2032	226.0938	211.2821	201.8389	207.0134	214.9465	230.3203	247.8754	260.8522	(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						
Northeast		3.9900	11.2829	0.6300	0.7000	0.7700	13.7584 (75)					
Northwest		3.7900	11.2829	0.6300	0.7000	0.7700	13.0687 (81)					
Solar gains	26.8271	54.6073	98.3851	161.5765	217.1906	231.5481	216.6085	172.6828	119.8837	66.7345	33.7554	21.9084 (83)
Total gains	295.1252	320.7502	354.7972	402.7798	443.2843	442.8303	418.4474	379.6963	334.8302	297.0548	281.6309	282.7606 (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	61.5416	61.7219	61.8996	62.7484	62.9098	63.6721	63.6721	63.8153	63.3763	62.9098	62.5841	62.2473	
alpha	5.1028	5.1148	5.1266	5.1832	5.1940	5.2448	5.2448	5.2544	5.2251	5.1940	5.1723	5.1498	
util living area	0.9975	0.9957	0.9894	0.9617	0.8712	0.6928	0.5282	0.5986	0.8625	0.9791	0.9953	0.9980	(86)
MIT	19.8149	19.9333	20.1707	20.5140	20.8074	20.9582	20.9917	20.9847	20.8668	20.4999	20.1061	19.7972	(87)
Th 2	19.9777	19.9804	19.9830	19.9954	19.9977	20.0085	20.0085	20.0105	20.0043	19.9977	19.9930	19.9881	(88)
util rest of house	0.9967	0.9943	0.9855	0.9471	0.8252	0.6039	0.4143	0.4797	0.7955	0.9685	0.9935	0.9974	(89)
MIT 2	18.4006	18.5752	18.9221	19.4204	19.8088	19.9809	20.0054	20.0041	19.8943	19.4094	18.8370	18.3822	(90)
Living area fraction									fLA = Living area / (4) =			0.4259	(91)
MIT	19.0030	19.1537	19.4539	19.8862	20.2341	20.3971	20.4255	20.4218	20.3085	19.8739	19.3776	18.9849	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0030	19.1537	19.4539	19.8862	20.2341	20.3971	20.4255	20.4218	20.3085	19.8739	19.3776	18.9849	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9956	0.9926	0.9828	0.9452	0.8373	0.6403	0.4631	0.5307	0.8185	0.9668	0.9919	0.9964	(94)
Ext temp.	293.8215	318.3867	348.7054	380.7105	371.1431	283.5631	193.7685	201.4944	274.0719	287.2036	279.3429	281.7528	(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	778.2867	752.2998	681.7371	570.3575	441.9196	296.5976	195.7218	205.3027	319.1267	480.2257	639.0734	773.7498	(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	360.4421	291.5896	247.7756	136.5458	52.6577	0.0000	0.0000	0.0000	0.0000	143.6085	259.0059	366.0458	(98)
												1857.6710	(98)
												39.6007	(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													1988.9411 (211)
Space heating requirement	360.4421	291.5896	247.7756	136.5458	52.6577	0.0000	0.0000	0.0000	0.0000	143.6085	259.0059	366.0458	(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)	385.9123	312.1944	265.2844	146.1946	56.3787	0.0000	0.0000	0.0000	0.0000	153.7564	277.3083	391.9120	(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	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	(64)
Efficiency of water heater (217)m	87.0594	86.8856	86.4086	85.2229	83.0746	80.3000	80.3000	80.3000	80.3000	85.2307	86.5326	87.1465	(217)
Fuel for water heating, kWh/month	181.7515	159.0822	166.4284	149.6673	148.6517	135.4479	129.7694	144.6625	146.2601	156.9114	164.9798	177.3061	(219)
Water heating fuel used													1860.9183 (219)
Annual totals kWh/year													
Space heating fuel - main system													1988.9411 (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)													227.0943 (232)
Total delivered energy for all uses													4151.9537 (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	1988.9411	0.2160	429.6113 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1860.9183	0.2160	401.9584 (264)
Space and water heating			831.5696 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	227.0943	0.5190	117.8619 (268)
Total CO2, kg/m2/year			988.3566 (272)
Emissions per m2 for space and water heating			17.7269 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5125 (272b)
Emissions per m2 for pumps and fans			0.8298 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.7269 * 1.00) + 2.5125 + 0.8298, rounded to 2 d.p.			21.0700 (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	46.9100 (1b)	x 2.3700 (2b)	= 111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 111.1767 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1799 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3799 (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) =	0.3229 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4117	0.4036	0.3956	0.3552	0.3471	0.3068	0.3068	0.2987	0.3229	0.3471	0.3633	0.3794 (22b)
	0.5848	0.5815	0.5782	0.5631	0.5602	0.5471	0.5471	0.5446	0.5521	0.5602	0.5660	0.5720 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.4500	7.7800	22.6700	0.2500	5.6675	52.8000	1196.9760 (29a)
External Wall to Corridor	3.3700	2.1200	1.2500	0.2200	0.2750	52.8000	66.0000 (29a)
External Wall to Stairwell	11.1900		11.1900	0.2000	2.2380	52.8000	590.8320 (29a)
Plane Ceiling	43.8600		43.8600	0.0800	3.5088	9.0000	394.7400 (30)
Sloping Ceiling	3.3200		3.3200	0.2000	0.6640	9.0000	29.8800 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			92.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0593		(33)
AAC Party Wall			21.6500	0.0000	0.0000	52.8000	1143.1200 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7729.7380 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.7780 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9836 (36)
Total fabric heat loss							(33) + (36) = 31.0429 (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	21.4536	21.3328	21.2145	20.6586	20.5546	20.0704	20.0704	19.9808	20.2569	20.5546	20.7650	20.9850 (38)
Average = Sum(39)m / 12 =	52.4965	52.3758	52.2574	51.7015	51.5975	51.1133	51.1133	51.0237	51.2998	51.5975	51.8079	52.0279 (39)
												51.7010 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1191	1.1165	1.1140	1.1021	1.0999	1.0896	1.0896	1.0877	1.0936	1.0999	1.1044	1.1091 (40)
Days in month												1.1021 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5997 (42)											
Average daily hot water use (litres/day)	72.1921 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1135.8629 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	25.0250	21.8870	22.5854	19.6905	18.8935	16.3037	15.1078	17.3364	17.5434	20.4452	22.3175	24.2354	65								

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	12.8590	11.4213	9.2884	7.0319	5.2564	4.4377	4.7951	6.2329	8.3657	10.6222	12.3977	13.2164	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736	(68)
Pumps, fans	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	(71)
Total internal gains	33.6357	32.5700	30.3568	27.3480	25.3945	22.6440	20.3061	23.3016	24.3659	27.4801	30.9965	32.5744	(72)
	232.7059	231.6470	223.6606	210.6452	197.1333	184.3694	176.2464	179.2349	186.0725	199.1932	214.2682	225.8594	(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								
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)							
Northwest	1.2700	11.2829	0.4300	0.0000	0.7700	4.7444 (81)							
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)							
Solar gains	29.0644	59.1614	106.5900	175.0514	235.3035	250.8584	234.6729	187.0839	129.8816	72.2999	36.5705	23.7354	(83)
Total gains	261.7703	290.8084	330.2506	385.6967	432.4368	435.2278	410.9192	366.3189	315.9541	271.4931	250.8387	249.5948	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.9008	40.9951	41.0879	41.5297	41.6134	42.0076	42.0076	42.0814	41.8549	41.6134	41.4444	41.2692	
alpha	3.7267	3.7330	3.7392	3.7686	3.7742	3.8005	3.8005	3.8054	3.7903	3.7742	3.7630	3.7513	
util living area	0.9922	0.9876	0.9742	0.9312	0.8296	0.6671	0.5208	0.5928	0.8337	0.9607	0.9876	0.9935	(86)
MIT	19.2960	19.4633	19.7943	20.2610	20.6639	20.8976	20.9697	20.9511	20.7482	20.2346	19.6905	19.2664	(87)
Th 2	19.9853	19.9874	19.9894	19.9991	20.0009	20.0093	20.0093	20.0109	20.0061	20.0009	19.9972	19.9934	(88)
util rest of house	0.9904	0.9847	0.9679	0.9137	0.7867	0.5887	0.4146	0.4840	0.7743	0.9475	0.9842	0.9920	(89)
MIT 2	18.4271	18.5949	18.9240	19.3849	19.7564	19.9529	19.9984	19.9915	19.8440	19.3686	18.8293	18.4038	(90)
Living area fraction	18.7972	18.9648	19.2947	19.7580	20.1429	20.3553	20.4121	20.4002	fLA = Living area / (4) =	20.2291	19.7375	19.1961	0.4259 (91)
MIT	18.7972	18.9648	19.2947	19.7580	20.1429	20.3553	20.4121	20.4002	20.2291	19.7375	19.1961	18.7712	(92)
Temperature adjustment	18.7972	18.9648	19.2947	19.7580	20.1429	20.3553	20.4121	20.4002	20.2291	19.7375	19.1961	0.0000	(93)
adjusted MIT	18.7972	18.9648	19.2947	19.7580	20.1429	20.3553	20.4121	20.4002	20.2291	19.7375	19.1961	18.7712	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9876	0.9809	0.9625	0.9087	0.7934	0.6176	0.4591	0.5288	0.7893	0.9431	0.9806	0.9896	(94)
Ext temp.	258.5318	285.2616	317.8558	350.4808	343.1140	268.7838	188.6660	193.7208	249.3886	256.0427	245.9791	246.9884	(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	761.0532	736.6526	668.6162	561.3763	435.6332	294.1717	194.8491	204.1067	314.4223	471.4700	626.6739	758.1102	(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	373.8759	303.3348	260.9657	151.8448	68.8343	0.0000	0.0000	0.0000	0.0000	160.2779	274.1002	380.2746	(98)
Space heating per m2												1973.5082 (98)	
												(98) / (4) = 42.0701 (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	
	0.0000	0.0000	0.0000	0.0000	0.0000	480.4653	378.2387	387.7799	0.0000	0.0000	0.0000	0.0000	(100)

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	0.8533	0.9056	0.8726	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	409.9667	342.5240	338.3653	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	569.7564	540.2258	489.0361	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	115.0486	147.0902	112.0990	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												374.2378 (104)
Cooled fraction												FC = cooled area / (4) =
Intermittency factor (Table 10b)												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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	28.7622	36.7725	28.0248	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.5594 (107)
Space cooling per m2												1.9944 (108)
Energy for space heating												42.0701 (99)
Energy for space cooling												1.9944 (108)
Total												44.0645 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	2.3700 (2b)	111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		111.1767 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	111.1767 (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				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) =				20.0000 / (5) =	0.1799 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4299	(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) =		0.3654 (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	0.4659	0.4568	0.4476	0.4020	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4111	0.4294 (22b)
Effective ac	0.6085	0.6043	0.6002	0.5808	0.5772	0.5603	0.5603	0.5571	0.5668	0.5772	0.5845	0.5922 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.7800	1.3258	10.3144		(27)
External Wall	30.4500	7.7800	22.6700	0.1800	4.0806		(29a)
External Wall to Corridor	3.3700	2.1200	1.2500	0.1800	0.2250		(29a)
External Wall to Stairwell	11.1900		11.1900	0.1800	2.0142		(29a)
Plane Ceiling	43.8600		43.8600	0.1300	5.7018		(30)
Sloping Ceiling	3.3200		3.3200	0.1300	0.4316		(30)
Dormer roof	0.5100		0.5100	0.1300	0.0663		(30)
Total net area of external elements Aum(A, m2)			92.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.9539	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6541	(36)
Total fabric heat loss	(33) + (36) =	30.6080 (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	22.3259	22.1713	22.0198	21.3079	21.1747	20.5547	20.5547	20.4399	20.7935	21.1747	21.4442	21.7258 (38)
Heat transfer coeff	52.9339	52.7793	52.6278	51.9159	51.7827	51.1627	51.1627	51.0479	51.4015	51.7827	52.0522	52.3338 (39)
Average = Sum(39)m / 12 =												51.9153 (39)
HLP	1.1284	1.1251	1.1219	1.1067	1.1039	1.0907	1.0907	1.0882	1.0957	1.1039	1.1096	1.1156 (40)
HLP (average)												1.1067 (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	1.5997	(42)										
Average daily hot water use (litres/day)	72.1921	(43)										
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)										Total = Sum(45)m =		1135.8629 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
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	0.0000	(57)
Heat gains from water heating, kWh/month	25.0250	21.8870	22.5854	19.6905	18.8935	16.3037	15.1078	17.3364	17.5434	20.4452	22.3175	24.2354			(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	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	79.9834	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.8590	11.4213	9.2884	7.0319	5.2564	4.4377	4.7951	6.2329	8.3657	10.6222	12.3977	13.2164	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.2161	140.6608	137.0204	129.2703	119.4873	110.2927	104.1501	102.7055	106.3459	114.0959	123.8789	133.0736	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	30.9983	(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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	(71)
Water heating gains (Table 5)	33.6357	32.5700	30.3568	27.3480	25.3945	22.6440	20.3061	23.3016	24.3659	27.4801	30.9965	32.5744	(72)
Total internal gains	232.7059	231.6470	223.6606	210.6452	197.1333	184.3694	176.2464	179.2349	186.0725	199.1932	214.2682	225.8594	(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					
Northeast	3.9900	11.2829	0.6300		0.7000		0.7700	13.7584 (75)					
Northwest	3.7900	11.2829	0.6300		0.7000		0.7700	13.0687 (81)					
Solar gains	26.8271	54.6073	98.3851	161.5765	217.1906	231.5481	216.6085	172.6828	119.8837	66.7345	33.7554	21.9084	(83)
Total gains	259.5330	286.2544	322.0456	372.2218	414.3239	415.9176	392.8549	351.9178	305.9563	265.9277	248.0236	247.7678	(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)													21.0000 (85)
tau	61.5416	61.7219	61.8996	62.7484	62.9098	63.6721	63.6721	63.8153	63.3763	62.9098	62.5841	62.2473	
alpha	5.1028	5.1148	5.1266	5.1832	5.1940	5.2448	5.2448	5.2544	5.2251	5.1940	5.1723	5.1498	
util living area	0.9986	0.9975	0.9930	0.9719	0.8945	0.7257	0.5594	0.6385	0.8945	0.9869	0.9974	0.9989	(86)
MIT	19.7442	19.8653	20.1079	20.4623	20.7760	20.9481	20.9892	20.9795	20.8362	20.4425	20.0397	19.7273	(87)
Th 2	19.9777	19.9804	19.9830	19.9954	19.9977	20.0085	20.0085	20.0105	20.0043	19.9977	19.9930	19.9881	(88)
util rest of house	0.9982	0.9966	0.9904	0.9606	0.8534	0.6368	0.4404	0.5152	0.8359	0.9799	0.9963	0.9986	(89)
MIT 2	18.8304	18.9534	19.1969	19.5545	19.8441	19.9845	20.0057	20.0044	19.9078	19.5412	19.1378	18.8219	(90)
Living area fraction													0.4259 (91)
MIT	19.2196	19.3418	19.5849	19.9411	20.2410	20.3949	20.4246	20.4197	20.3032	19.9251	19.5220	19.2076	(92)
Temperature adjustment													0.0000
adjusted MIT	19.2196	19.3418	19.5849	19.9411	20.2410	20.3949	20.4246	20.4197	20.3032	19.9251	19.5220	19.2076	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9958	0.9891	0.9598	0.8646	0.6734	0.4915	0.5683	0.8562	0.9792	0.9956	0.9982	(94)
Useful gains	258.9367	285.0580	318.5292	357.2623	358.2370	280.0780	193.1039	199.9934	261.9520	260.3996	246.9442	247.3216	(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	789.7516	762.2260	688.6311	573.2110	442.2750	296.4840	195.6756	205.1986	318.8555	482.8806	646.5894	785.4035	(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	394.9263	320.6569	275.3559	155.4831	62.5242	0.0000	0.0000	0.0000	0.0000	165.5259	287.7445	400.3330	(98)
Space heating												2062.5497	(98)
Space heating per m2												43.9682	(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	480.9296	378.6042	387.9641	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8888	0.9399	0.9102	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	427.4514	355.8613	353.1211	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	547.1859	519.1116	472.2036	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	86.2088	121.4582	88.5974	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												296.2644 (104)	
Cooled fraction												FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	21.5522	30.3646	22.1493	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling													74.0661 (107)
Space cooling per m2													1.5789 (108)
Energy for space heating													43.9682 (99)
Energy for space cooling													1.5789 (108)
Total													45.5471 (109)
Target Fabric Energy Efficiency (TFEE)													52.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.9100 (1b)	2.3700 (2b)	111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		111.1767 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 111.1767 (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)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes								
Measured/design AP50				4.0000								
Infiltration rate				0.2000	0.2000 (18)							
Number of sides sheltered				2	2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (21)							
Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.7000	Apr 4.2000	May 4.2000	Jun 3.7000	Jul 3.8000	Aug 3.8000	Sep 4.0000	Oct 4.2000	Nov 4.3000	Dec 4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	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					
DTC			2.1200	1.0800	2.2896		(26)					
Windows (Uw = 1.40)			5.2600	1.3258	6.9735		(27)					
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)					
External Wall	30.4500	7.7800	22.6700	0.2500	5.6675	52.8000	1196.9760 (29a)					
External Wall to Corridor	3.3700	2.1200	1.2500	0.2200	0.2750	52.8000	66.0000 (29a)					
External Wall to Stairwell	11.1900		11.1900	0.2000	2.2380	52.8000	590.8320 (29a)					
Plane Ceiling	43.8600		43.8600	0.0800	3.5088	9.0000	394.7400 (30)					
Sloping Ceiling	3.3200		3.3200	0.2000	0.6640	9.0000	29.8800 (30)					
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)					
Total net area of external elements Aum(A, m ²)			92.7000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0593		(33)					
AAC Party Wall			21.6500	0.0000	0.0000	52.8000	1143.1200 (32)					
E-FC-4			46.9100			70.0000	3283.7000 (32d)					
Metal			72.8500			14.0000	1019.9000 (32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7729.7380 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.7780 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9836 (36)					
Total fabric heat loss						(33) + (36) =	31.0429 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 18.3442	Feb 18.3442	Mar 18.3442	Apr 18.3442	May 18.3442	Jun 18.3442	Jul 18.3442	Aug 18.3442	Sep 18.3442	Oct 18.3442	Nov 18.3442	Dec 18.3442 (38)
Heat transfer coeff	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871 (39)
Average = Sum(39)m / 12 =												49.3871 (39)
HLP	Jan 1.0528	Feb 1.0528	Mar 1.0528	Apr 1.0528	May 1.0528	Jun 1.0528	Jul 1.0528	Aug 1.0528	Sep 1.0528	Oct 1.0528	Nov 1.0528	Dec 1.0528 (40)
HLP (average)												1.0528 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m =											1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m												
	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month												
	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
	Total per year (kWh/year) = Sum(64)m =											1299.8227 (64)
	1300 (64)											
RHI water heating demand												
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1475	28.5532	23.2210	17.5798	13.1411	11.0943	11.9877	15.5821	20.9143	26.5555	30.9942	33.0410 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7853	209.9415	204.5080	192.9408	178.3393	164.6160	155.4479	153.2918	158.7252	170.2924	184.8939	198.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	378.4518	375.3409	361.1051	339.1803	317.0776	296.9965	285.0596	291.1922	303.6272	325.7168	350.2691	368.5142 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	Specific data	FF	Access	Gains				
		m ²	Table 6a	W/m ²	or Table 6b	or Table 6c	factor	W				
							Table 6d					
Northeast		3.9900	12.9465	0.4300		0.0000	0.7700	17.1035 (75)				
Northwest		1.2700	12.9465	0.4300		0.0000	0.7700	5.4440 (81)				
Northwest		2.5200	12.9465	0.4300		0.0000	0.7700	10.8022 (81)				
Solar gains	33.3497	63.4935	112.6482	193.9807	250.6951	277.9635	257.7026	207.7391	145.4378	81.1798	43.0412	26.9372 (83)
Total gains	411.8016	438.8345	473.7533	533.1610	567.7727	574.9600	542.7622	498.9313	449.0650	406.8966	393.3103	395.4514 (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	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759
alpha	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984
util living area	0.9628	0.9506	0.9145	0.8202	0.6625	0.4662	0.3072	0.3333	0.6088	0.8518	0.9409	0.9671 (86)
MIT	19.8526	19.9801	20.2748	20.6331	20.8774	20.9761	20.9966	20.9955	20.9356	20.6418	20.1945	19.8132 (87)
Th 2	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396 (88)
util rest of house	0.9554	0.9409	0.8973	0.7862	0.6059	0.3918	0.2215	0.2408	0.5280	0.8143	0.9271	0.9604 (89)
MIT 2	18.5415	18.7232	19.1391	19.6226	19.9230	20.0237	20.0385	20.0381	19.9911	19.6473	19.0327	18.4856 (90)
Living area fraction	fLA = Living area / (4) =											0.4259 (91)
MIT	19.0999	19.2585	19.6228	20.0530	20.3295	20.4293	20.4466	20.4459	20.3934	20.0709	19.5275	19.0510 (92)
Temperature adjustment												
adjusted MIT	19.0999	19.2585	19.6228	20.0530	20.3295	20.4293	20.4466	20.4459	20.3934	20.0709	19.5275	19.0510 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9463	0.9312	0.8887	0.7867	0.6237	0.4225	0.2580	0.2802	0.5590	0.8157	0.9183	0.9518 (94)
Ext temp.	389.6782	408.6462	421.0010	419.4436	354.1293	242.9437	140.0452	139.8244	251.0321	331.8928	361.1904	376.3811 (95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Month fracti	711.1703	694.3093	623.4054	521.1814	386.6755	248.3841	140.5838	140.5490	266.3649	428.2311	584.1273	708.7551 (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	239.1901	191.9656	150.5889	73.2513	24.2144	0.0000	0.0000	0.0000	0.0000	71.6757	160.5145	247.2863 (98)
RHI space heating demand												1159 (98)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	2.3700 (2b)	111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		111.1767 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 111.1767 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2000 (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) =	0.1700 (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 infiltr rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.4500	7.7800	22.6700	0.2500	5.6675	52.8000	1196.9760 (29a)
External Wall to Corridor	3.3700	2.1200	1.2500	0.2200	0.2750	52.8000	66.0000 (29a)
External Wall to Stairwell	11.1900		11.1900	0.2000	2.2380	52.8000	590.8320 (29a)
Plane Ceiling	43.8600		43.8600	0.0800	3.5088	9.0000	394.7400 (30)
Sloping Ceiling	3.3200		3.3200	0.2000	0.6640	9.0000	29.8800 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			92.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0593		(33)
AAC Party Wall			21.6500	0.0000	0.0000	52.8000	1143.1200 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7729.7380 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.7780 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9836 (36)
Total fabric heat loss						(33) + (36) =	31.0429 (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	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442 (38)
Heat transfer coeff	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871 (39)
Average = Sum(39)m / 12 =												49.3871 (39)
HLP	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528 (40)
HLP (average)												1.0528 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m = 1135.8629 (45)											
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											Total per year (kWh/year) = Sum(64)m = 1299.8227 (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	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1475	28.5532	23.2210	17.5798	13.1411	11.0943	11.9877	15.5821	20.9143	26.5555	30.9942	33.0410 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7853	209.9415	204.5080	192.9408	178.3393	164.6160	155.4479	153.2918	158.7252	170.2924	184.8939	198.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	378.4518	375.3409	361.1051	339.1803	317.0776	296.9965	285.0596	291.1922	303.6272	325.7168	350.2691	368.5142 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains						
	m2	Table 6a	g	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Northwest	1.2700	11.2829	0.4300	0.0000	0.7700	4.7444 (81)						
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)						
Solar gains	29.0644	59.1614	106.5900	175.0514	235.3035	250.8584	234.6729	187.0839	129.8816	72.2999	36.5705	23.7354 (83)
Total gains	407.5162	434.5023	467.6951	514.2317	552.3810	547.8549	519.7325	478.2761	433.5088	398.0167	386.8396	392.2497 (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	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759
alpha	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984
util living area	0.9666	0.9546	0.9248	0.8509	0.7168	0.5463	0.4099	0.4609	0.6911	0.8832	0.9504	0.9708 (86)
MIT	19.7898	19.9318	20.2034	20.5506	20.8221	20.9528	20.9880	20.9811	20.8843	20.5447	20.1045	19.7392 (87)
Th 2	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396 (88)
util rest of house	0.9599	0.9457	0.9097	0.8218	0.6664	0.4743	0.3240	0.3706	0.6207	0.8535	0.9390	0.9650 (89)
MIT 2	18.4511	18.6541	19.0391	19.5149	19.8596	20.0035	20.0335	20.0293	19.9397	19.5193	18.9050	18.3787 (90)
Living area fraction	FLA = Living area / (4) = 0.4259 (91)											
MIT	19.0213	19.1983	19.5350	19.9560	20.2695	20.4078	20.4400	20.4347	20.3420	19.9560	19.4159	18.9582 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0213	19.1983	19.5350	19.9560	20.2695	20.4078	20.4400	20.4347	20.3420	19.9560	19.4159	18.9582 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9511	0.9362	0.9005	0.8190	0.6791	0.5027	0.3603	0.4085	0.6441	0.8506	0.9300	0.9567 (94)
Useful gains	387.5984	406.7603	421.1553	421.1577	375.1439	275.3839	187.2658	195.3807	279.2322	338.5453	359.7678	375.2495 (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	727.0407	706.1518	643.7619	546.0227	423.2238	286.8304	189.6485	199.2621	308.2759	462.0679	608.2457	728.8619 (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	252.5451	201.1911	165.6193	89.9028	35.7715	0.0000	0.0000	0.0000	0.0000	91.9008	178.9041	263.0877 (98)
Space heating	1278.9224 (98)											
Space heating per m2	(98) / (4) = 27.2633 (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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1367.8314 (211)
Space heating requirement	252.5451	201.1911	165.6193	89.9028	35.7715	0.0000	0.0000	0.0000	0.0000	91.9008	178.9041	263.0877	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	270.1017	215.1777	177.1329	96.1528	38.2583	0.0000	0.0000	0.0000	0.0000	98.2896	191.3413	281.3772	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.3769	89.3054	89.1259	88.7390	88.1041	87.3000	87.3000	87.3000	87.3000	88.7271	89.1971	87.3000	(216)
Fuel for water heating, kWh/month	147.4047	129.4571	134.8977	119.5996	116.6939	103.2711	97.3228	109.3613	109.9774	124.1326	132.8847	143.1589	(219)
Water heating fuel used													1468.1619 (219)
Annual totals kWh/year													
Space heating fuel - main system													1367.8314 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420													
mechanical ventilation fans (SFP = 0.2420)													32.8303 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.8303 (231)
Electricity for lighting (calculated in Appendix L)													227.0943 (232)
Total delivered energy for all uses													3170.9179 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1367.8314	3.4800	47.6005 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1468.1619	3.4800	51.0920 (247)
Mechanical ventilation fans	32.8303	13.1900	4.3303 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	227.0943	13.1900	29.9537 (250)
Additional standing charges			120.0000 (251)
Total energy cost			262.8691 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2012 (257)
SAP value		83.2428
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1367.8314	0.2160	295.4516 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1468.1619	0.2160	317.1230 (264)
Space and water heating			612.5746 (265)
Pumps and fans	107.8303	0.5190	55.9639 (267)
Energy for lighting	227.0943	0.5190	117.8619 (268)
Total kg/year			786.4004 (272)
CO2 emissions per m2			16.7600 (273)
EI value			88.5347
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8843 = 3.935$, stars = 4
 $0.216 / 0.8843 = 0.2443$, 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	46.9100 (1b)	2.3700 (2b)	111.1767 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		111.1767 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 111.1767 (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					4.0000
Infiltration rate					0.2000 (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) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised	0.5000 (23a)											
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	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
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	30.4500	7.7800	22.6700	0.2500	5.6675	52.8000	1196.9760 (29a)
External Wall to Corridor	3.3700	2.1200	1.2500	0.2200	0.2750	52.8000	66.0000 (29a)
External Wall to Stairwell	11.1900		11.1900	0.2000	2.2380	52.8000	590.8320 (29a)
Plane Ceiling	43.8600		43.8600	0.0800	3.5088	9.0000	394.7400 (30)
Sloping Ceiling	3.3200		3.3200	0.2000	0.6640	9.0000	29.8800 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			92.7000			(31)	
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0593		(33)
AAC Party Wall			21.6500	0.0000	0.0000	52.8000	1143.1200 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7729.7380 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.7780 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9836 (36)
Total fabric heat loss					(33) + (36) =		31.0429 (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	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442	18.3442 (38)
Average = Sum(39)m / 12 =	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871	49.3871 (39)
HLP	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528	1.0528 (40)
HLP (average)	1.0528 (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	1.5997 (42)											
Average daily hot water use (litres/day)	72.1921 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)	Total = Sum(45)m = 1135.8629 (45)											
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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	13.9810	12.6144	13.9444	13.4701	13.9014	13.4324	13.8674	13.8894	13.4530	13.9266	13.5057	13.9739 (61)
Total heat required for water heating calculated for each month	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227 (64)
Heat gains from water heating, kWh/month	42.6520	37.4004	38.8257	34.1774	33.0382	28.8686	27.1061	30.5987	30.8136	35.4723	38.2968	41.4147 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											Total per year (kWh/year) = Sum(64)m = 1299.8227 (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	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801	95.9801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1475	28.5532	23.2210	17.5798	13.1411	11.0943	11.9877	15.5821	20.9143	26.5555	30.9942	33.0410 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7853	209.9415	204.5080	192.9408	178.3393	164.6160	155.4479	153.2918	158.7252	170.2924	184.8939	198.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977	46.1977 (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)	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867	-63.9867 (71)
Water heating gains (Table 5)	57.3280	55.6553	52.1851	47.4687	44.4061	40.0953	36.4329	41.1273	42.7966	47.6779	53.1899	55.6649 (72)
Total internal gains	378.4518	375.3409	361.1051	339.1803	317.0776	296.9965	285.0596	291.1922	303.6272	325.7168	350.2691	368.5142 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains						
	m2	Table 6a	g	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Northwest	1.2700	12.9465	0.4300	0.0000	0.7700	5.4440 (81)						
Northwest	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)						
Solar gains	33.3497	63.4935	112.6482	193.9807	250.6951	277.9635	257.7026	207.7391	145.4378	81.1798	43.0412	26.9372 (83)
Total gains	411.8016	438.8345	473.7533	533.1610	567.7727	574.9600	542.7622	498.9313	449.0650	406.8966	393.3103	395.4514 (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	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759	43.4759
alpha	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984	3.8984
util living area	0.9628	0.9506	0.9145	0.8202	0.6625	0.4662	0.3072	0.3333	0.6088	0.8518	0.9409	0.9671 (86)
MIT	19.8526	19.9801	20.2748	20.6331	20.8774	20.9761	20.9966	20.9955	20.9356	20.6418	20.1945	19.8132 (87)
Th 2	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396	20.0396 (88)
util rest of house	0.9554	0.9409	0.8973	0.7862	0.6059	0.3918	0.2215	0.2408	0.5280	0.8143	0.9271	0.9604 (89)
MIT 2	18.5415	18.7232	19.1391	19.6226	19.9230	20.0237	20.0385	20.0381	19.9911	19.6473	19.0327	18.4856 (90)
Living area fraction	FLA = Living area / (4) = 0.4259 (91)											
MIT	19.0999	19.2585	19.6228	20.0530	20.3295	20.4293	20.4466	20.4459	20.3934	20.0709	19.5275	19.0510 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0999	19.2585	19.6228	20.0530	20.3295	20.4293	20.4466	20.4459	20.3934	20.0709	19.5275	19.0510 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9463	0.9312	0.8887	0.7867	0.6237	0.4225	0.2580	0.2802	0.5590	0.8157	0.9183	0.9518 (94)
Useful gains	389.6782	408.6462	421.0010	419.4436	354.1293	242.9437	140.0452	139.8244	251.0321	331.8928	361.1904	376.3811 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	711.1703	694.3093	623.4054	521.1814	386.6755	248.3841	140.5838	140.5490	266.3649	428.2311	584.1273	708.7551 (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	239.1901	191.9656	150.5889	73.2513	24.2144	0.0000	0.0000	0.0000	0.0000	71.6757	160.5145	247.2863 (98)
Space heating	1158.6867 (98)											
Space heating per m2	(98) / (4) = 24.7002 (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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1239.2371 (211)
Space heating requirement	239.1901	191.9656	150.5889	73.2513	24.2144	0.0000	0.0000	0.0000	0.0000	71.6757	160.5145	247.2863	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	255.8183	205.3108	161.0576	78.3436	25.8977	0.0000	0.0000	0.0000	0.0000	76.6585	171.6733	264.4773	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.3369	89.2700	89.0509	88.5790	87.8924	87.3000	87.3000	87.3000	87.3000	88.5341	89.1125	87.3000	(216)
Fuel for water heating, kWh/month	147.4706	129.5084	135.0114	119.8157	116.9750	103.2711	97.3228	109.3613	109.9774	124.4031	133.0108	143.2304	(219)
Water heating fuel used													1469.3579 (219)
Annual totals kWh/year													
Space heating fuel - main system													1239.2371 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													32.8303 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.8303 (231)
Electricity for lighting (calculated in Appendix L)													227.0943 (232)
Total delivered energy for all uses													3043.5195 (238)

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1239.2371	3.9200	48.5781 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1469.3579	3.9200	57.5988 (247)
Mechanical ventilation fans	32.8303	16.9600	5.5680 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	227.0943	16.9600	38.5152 (250)
Additional standing charges			88.0000 (251)
Total energy cost			250.9801 (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	1239.2371	0.2160	267.6752 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1469.3579	0.2160	317.3813 (264)
Space and water heating			585.0565 (265)
Pumps and fans	107.8303	0.5190	55.9639 (267)
Energy for lighting	227.0943	0.5190	117.8619 (268)
Total kg/year			758.8824 (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	1239.2371	1.2200	1511.8692 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1469.3579	1.2200	1792.6166 (264)
Space and water heating			3304.4858 (265)
Pumps and fans	107.8303	3.0700	331.0389 (267)
Energy for lighting	227.0943	3.0700	697.1795 (268)
Primary energy kWh/year			4332.7042 (272)
Primary energy kWh/m2/year			92.3621 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 83
 Current environmental impact rating: B 89

(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: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0		0.00 kg/m ²

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 2019)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£57	£57	£0
Mains gas	£194	£194	£0
Space heating	£155	£155	£0
Water heating	£58	£58	£0
Lighting	£39	£39	£0
Total cost of fuels	£251	£251	£0
Total cost of uses	£252	£252	£0
Delivered energy	65 kWh/m ²	65 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	16 kg/m ²	16 kg/m ²	0 kg/m ²
Primary energy	92 kWh/m ²	92 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 Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	East Anglia
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	164.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	146.75 (P1)
Transmission heat loss coefficient	31.04 (37)
Summer heat loss coefficient	177.80 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
North West	1.2700	100.0415	0.4300	0.0000	0.9000	49.1694
North West	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644

total: 301.2108

	Jun	Jul	Aug
Solar gains	325	301	243
Internal gains	294	282	288
Total summer gains	619	583	531

	3.48	3.28	2.99
Summer gain/loss ratio			(P6)
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 164.8)	0.85	0.85	0.85
Threshold temperature	19.73	21.73	21.43
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight