

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-017			Issued on Date	12/02/2020
Assessment Reference	017	Prop Type Ref	GFF Semi		
Property	Plot 017, 2 Bed, K, Ba, ES, Welwyn Garden City				
SAP Rating	84 B	DER	17.56	TER	19.51
Environmental	88 B	% DER<TER	10.00		
CO ₂ Emissions (t/year)	0.84	DFEE	41.65	TFEE	48.56
General Requirements Compliance	Pass	% DFEE<TFEE	14.22		
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				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 56 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.51 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.56 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof (no roof)			
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 South West: 3.97 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

10 Key features

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (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	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:												
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)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	34.1200	7.9600	26.1600	0.2500	6.5400	52.8000	1381.2480 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			110.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.4686		(33)
AAC Party Wall			24.9900	0.0000	0.0000	52.8000	1319.4720 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2111 (36)
Total fabric heat loss						(33) + (36) =	36.6797 (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	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413 (38)
Heat transfer coeff	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210 (39)
Average = Sum(39)m / 12 =												58.9210 (39)
HLP	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447 (40)
HLP (average)												1.0447 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156	(61)
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
	Total per year (kWh/year) = Sum(64)m =											1404.3028 (64)	
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005	(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	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502	(72)
Total internal gains	295.7624	293.8871	283.2215	266.2102	249.1978	232.6781	221.8876	227.0618	235.7611	252.9524	272.6392	287.1546	(73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	Specific data	Access	Gains							
	m ²	Table 6a	g	FF	factor	W							
		W/m ²	or Table 6b	or Table 6c	Table 6d								
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)							
Southwest	1.4500	36.7938	0.4300	0.0000	0.7700	17.6645 (79)							
Southwest	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)							
Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625	(83)
Total gains	359.0324	406.6105	450.6055	495.6502	526.3096	516.6361	491.9705	460.2263	424.4222	381.0816	349.3238	340.7172	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	
alpha	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	
util living area	0.9967	0.9931	0.9830	0.9491	0.8557	0.6856	0.5180	0.5731	0.8207	0.9666	0.9933	0.9975	(86)
MIT	19.8952	20.0386	20.2740	20.5720	20.8278	20.9596	20.9922	20.9871	20.8973	20.5687	20.1671	19.8530	(87)
Th 2	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	(88)
util rest of house	0.9957	0.9910	0.9774	0.9318	0.8095	0.6005	0.4103	0.4621	0.7496	0.9518	0.9908	0.9967	(89)
MIT 2	18.5723	18.7812	19.1217	19.5425	19.8764	20.0187	20.0432	20.0407	19.9630	19.5452	18.9693	18.5109	(90)
Living area fraction	19.0778	19.2616	19.5620	19.9359	20.2399	20.3782	20.4058	20.4023	20.3200	19.9363	19.4269	19.0237	(92)
Temperature adjustment	19.0778	19.2616	19.5620	19.9359	20.2399	20.3782	20.4058	20.4023	20.3200	19.9363	19.4269	19.0237	(93)
adjusted MIT	19.0778	19.2616	19.5620	19.9359	20.2399	20.3782	20.4058	20.4023	20.3200	19.9363	19.4269	19.0237	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9942	0.9886	0.9738	0.9294	0.8199	0.6315	0.4517	0.5047	0.7720	0.9497	0.9885	0.9955	(94)
Ext temp.	356.9605	401.9679	438.7801	460.6481	431.5091	326.2529	222.2133	232.2666	327.6744	361.9206	345.3193	339.1916	(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	870.7212	846.2023	769.6245	650.2441	503.1827	340.4585	224.2431	235.8202	366.4864	550.1048	726.3163	873.4273	(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 m ²	382.2380	298.5256	246.1482	136.5092	53.3251	0.0000	0.0000	0.0000	0.0000	140.0090	274.3178	397.4714	(98)
												1928.5442 (98)	
												(98) / (4) =	34.1940 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (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													2062.6141 (211)
Space heating requirement	382.2380	298.5256	246.1482	136.5092	53.3251	0.0000	0.0000	0.0000	0.0000	140.0090	274.3178	397.4714	(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)	408.8107	319.2787	263.2601	145.9991	57.0322	0.0000	0.0000	0.0000	0.0000	149.7423	293.3880	425.1031	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.6077	89.5309	89.3678	89.0106	88.3134	87.3000	87.3000	87.3000	87.3000	89.0012	89.4557	89.6507	(217)
Fuel for water heating, kWh/month	159.1176	139.7148	145.4724	128.8092	125.6755	111.3518	104.8107	117.9550	118.6751	133.6942	143.3015	154.5070	(219)
Water heating fuel used													1583.0850 (219)
Annual totals kWh/year													
Space heating fuel - main system													2062.6141 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)													39.4399 (230a)
mechanical ventilation fans (SFP = 0.2398)													30.0000 (230c)
central heating pump													45.0000 (230e)
main heating flue fan													114.4399 (231)
Total electricity for the above, kWh/year													276.1610 (232)
Electricity for lighting (calculated in Appendix L)													4036.3000 (238)
Total delivered energy for all uses													

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	2062.6141	0.2160	445.5246	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1583.0850	0.2160	341.9464	(264)
Space and water heating			787.4710	(265)
Pumps and fans	114.4399	0.5190	59.3943	(267)
Energy for lighting	276.1610	0.5190	143.3275	(268)
Total CO2, kg/year			990.1929	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5600	(273)

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

DER			17.5600 ZC1
Total Floor Area		TFA	56.4000
Assumed number of occupants		N	1.8782
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			17.2085 ZC2
CO2 emissions from cooking, equation (L16)			2.9092 ZC3
Total CO2 emissions			37.6777 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			37.6777 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (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) =	0.1484 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3984	(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) =		0.3386 (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	0.4317	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3809	0.3979 (22b)
	0.5932	0.5896	0.5860	0.5694	0.5663	0.5517	0.5517	0.5491	0.5573	0.5663	0.5726	0.5792 (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)			7.9600	1.3258	10.5530		(27)
Jetfloor Grey			56.4000	0.1300	7.3320		(28a)
External Wall	34.1200	7.9600	26.1600	0.1800	4.7088		(29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.1800	3.2634		(29a)
Total net area of external elements Aum(A, m ²)			110.7700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9772	(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)							7.5861 (36)
Total fabric heat loss						(33) + (36) =	35.5633 (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	26.3870	26.2261	26.0683	25.3271	25.1884	24.5429	24.5429	24.4234	24.7916	25.1884	25.4690	25.7622 (38)
Heat transfer coeff	61.9504	61.7894	61.6316	60.8904	60.7518	60.1062	60.1062	59.9867	60.3549	60.7518	61.0323	61.3256 (39)
Average = Sum(39)m / 12 =												60.8898 (39)
HLP	1.0984	1.0956	1.0928	1.0796	1.0772	1.0657	1.0657	1.0636	1.0701	1.0772	1.0821	1.0873 (40)
HLP (average)												1.0796 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m = 1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	44.1759	38.4498	40.9631	38.0871	37.7503	34.9779	36.1439	37.7503	38.0871	40.9631	41.1962	44.1759 (61)
Total heat required for water heating calculated for each month	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770 (64)
Heat gains from water heating, kWh/month	53.7893	46.9978	48.8191	43.1553	41.7098	36.5929	34.8417	39.0500	39.4878	45.1633	48.4198	52.4406 (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	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912 (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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	72.2975	69.9373	65.6171	59.9380	56.0615	50.8235	46.8302	52.4865	54.8442	60.7034	67.2497	70.4847 (72)
Total internal gains	305.8940	303.4850	292.2882	274.7473	257.2022	240.1512	229.3659	235.0710	244.3053	262.0263	282.2412	297.2891 (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)						
Southwest	3.9700	36.7938	0.6300	0.7000	0.7700	44.6414 (79)						
Solar gains	58.3997	104.0463	154.4994	211.7785	255.7807	262.0998	249.2927	215.2162	174.1386	118.2662	70.7816	49.4395 (83)
Total gains	364.2937	407.5313	446.7876	486.5258	512.9829	502.2511	478.6586	450.2873	418.4439	380.2925	353.0228	346.7286 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.2227	63.3874	63.5497	64.3232	64.4700	65.1624	65.1624	65.2923	64.8939	64.4700	64.1737	63.8668	
alpha	5.2148	5.2258	5.2366	5.2882	5.2980	5.3442	5.3442	5.3528	5.3263	5.2980	5.2782	5.2578	
util living area	0.9972	0.9944	0.9866	0.9592	0.8789	0.7131	0.5419	0.5948	0.8399	0.9718	0.9943	0.9978 (86)	
MIT	19.8716	20.0085	20.2379	20.5444	20.8074	20.9551	20.9914	20.9862	20.8902	20.5574	20.1615	19.8474 (87)	
Th 2	20.0021	20.0045	20.0068	20.0175	20.0195	20.0289	20.0289	20.0307	20.0253	20.0195	20.0155	20.0112 (88)	
util rest of house	0.9963	0.9925	0.9818	0.9439	0.8349	0.6254	0.4279	0.4785	0.7692	0.9583	0.9920	0.9971 (89)	
MIT 2	18.5007	18.7018	19.0362	19.4797	19.8289	19.9987	20.0257	20.0249	19.9368	19.5059	18.9337	18.4720 (90)	
Living area fraction	fLA = Living area / (4) =												0.3821 (91)
MIT	19.0245	19.2011	19.4954	19.8865	20.2028	20.3642	20.3947	20.3922	20.3011	19.9077	19.4028	18.9975 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.0245	19.2011	19.4954	19.8865	20.2028	20.3642	20.3947	20.3922	20.3011	19.9077	19.4028	18.9975 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9905	0.9786	0.9415	0.8441	0.6573	0.4717	0.5232	0.7915	0.9564	0.9900	0.9961 (94)	
Useful gains	362.4627	403.6533	437.2424	458.0519	433.0222	330.1419	225.7906	235.5923	331.1903	363.7049	349.5091	345.3638 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	912.1892	883.6556	800.9275	668.9713	516.5579	346.4614	228.0842	239.4806	374.2660	565.4582	750.8687	907.4659 (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	408.9965	322.5616	270.5817	151.8620	62.1506	0.0000	0.0000	0.0000	0.0000	150.1044	288.9789	418.2039 (98)	
Space heating													2073.4396 (98)
Space heating per m2													(98) / (4) = 36.7631 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2219.9568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	408.9965	322.5616	270.5817	151.8620	62.1506	0.0000	0.0000	0.0000	0.0000	150.1044	288.9789	418.2039	(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)	437.8978	345.3550	289.7020	162.5931	66.5424	0.0000	0.0000	0.0000	0.0000	160.7114	309.3992	447.7558	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770	(64)
Efficiency of water heater	87.1453	86.9159	86.4095	85.2699	83.2344	80.3000	80.3000	80.3000	80.3000	85.1211	86.5845	87.2460	(216)
Fuel for water heating, kWh/month	198.2130	173.6011	181.6794	163.2939	161.9636	147.8614	141.6625	157.9205	159.6645	171.5124	179.9918	193.3348	(219)
Water heating fuel used													2030.6989 (219)
Annual totals kWh/year													
Space heating fuel - main system													2219.9568 (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)													276.1610 (232)
Total delivered energy for all uses													4601.8166 (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	2219.9568	0.2160	479.5107 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2030.6989	0.2160	438.6310 (264)
Space and water heating			918.1416 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total CO2, kg/m2/year			1100.3942 (272)
Emissions per m2 for space and water heating			16.2791 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5413 (272b)
Emissions per m2 for pumps and fans			0.6902 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2791 * 1.00) + 2.5413 + 0.6902, rounded to 2 d.p.			19.5100 (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	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1484 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3484	(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) =		0.2961 (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	0.3775	0.3701	0.3627	0.3257	0.3183	0.2813	0.2813	0.2739	0.2961	0.3183	0.3331	0.3479 (22b)
Effective ac	0.5713	0.5685	0.5658	0.5530	0.5507	0.5396	0.5396	0.5375	0.5438	0.5507	0.5555	0.5605 (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)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	34.1200	7.9600	26.1600	0.2500	6.5400	52.8000	1381.2480 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			110.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.4686		(33)
AAC Party Wall			24.9900	0.0000	0.0000	52.8000	1319.4720 (32)
E-FC-4			56.4000			30.0000	1692.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11181.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							198.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2111 (36)
Total fabric heat loss						(33) + (36) =	36.6797 (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	25.4117	25.2886	25.1679	24.6011	24.4951	24.0014	24.0014	23.9100	24.1916	24.4951	24.7096	24.9339 (38)
Heat transfer coeff	62.0914	61.9683	61.8476	61.2808	61.1748	60.6811	60.6811	60.5897	60.8713	61.1748	61.3893	61.6136 (39)
Average = Sum(39)m / 12 =												61.2803 (39)
HLP	1.1009	1.0987	1.0966	1.0865	1.0847	1.0759	1.0759	1.0743	1.0793	1.0847	1.0885	1.0924 (40)
HLP (average)												1.0865 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)										Total = Sum(45)m =		1239.9620 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.3185	23.8929	24.6553	21.4951	20.6251	17.7979	16.4924	18.9252	19.1512	22.3189	24.3629	26.4565	(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	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	36.7184	35.5549	33.1389	29.8543	27.7219	24.7193	22.1671	25.4371	26.5990	29.9986	33.8373	35.5598	(72)
Total internal gains	267.3149	266.1026	256.8100	241.6637	225.8626	211.0470	201.7028	205.0216	213.0600	228.3214	245.8288	259.3643	(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	0.4300		0.0000		0.7700	14.9058 (75)					
Southwest	1.4500	36.7938	0.4300		0.0000		0.7700	17.6645 (79)					
Southwest	2.5200	36.7938	0.4300		0.0000		0.7700	30.6997 (79)					
Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625	(83)
Total gains	330.5849	378.8260	424.1941	471.1037	502.9744	495.0050	471.7856	438.1861	401.7211	356.4507	322.5134	312.9268	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	50.0223	50.1217	50.2195	50.6840	50.7719	51.1849	51.1849	51.2621	51.0250	50.7719	50.5944	50.4103	
alpha	4.3348	4.3414	4.3480	4.3789	4.3848	4.4123	4.4123	4.4175	4.4017	4.3848	4.3730	4.3607	
util living area	0.9952	0.9907	0.9793	0.9452	0.8607	0.7053	0.5450	0.6017	0.8325	0.9637	0.9911	0.9962	(86)
MIT	19.5753	19.7468	20.0303	20.4020	20.7253	20.9206	20.9801	20.9696	20.8270	20.4088	19.9231	19.5415	(87)
Th 2	20.0001	20.0019	20.0036	20.0118	20.0134	20.0206	20.0206	20.0219	20.0178	20.0134	20.0103	20.0070	(88)
util rest of house	0.9939	0.9882	0.9734	0.9288	0.8188	0.6233	0.4333	0.4887	0.7679	0.9497	0.9883	0.9952	(89)
MIT 2	18.6995	18.8713	19.1530	19.5205	19.8180	19.9792	20.0142	20.0112	19.9132	19.5340	19.0541	18.6712	(90)
Living area fraction													fLA = Living area / (4) =
MIT	19.0341	19.2059	19.4882	19.8573	20.1647	20.3389	20.3832	20.3774	20.2623	19.8683	19.3861	19.0038	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0341	19.2059	19.4882	19.8573	20.1647	20.3389	20.3832	20.3774	20.2623	19.8683	19.3861	19.0038	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9922	0.9856	0.9696	0.9257	0.8259	0.6516	0.4760	0.5316	0.7859	0.9471	0.9859	0.9938	(94)
Useful gains	328.0137	373.3565	411.3046	436.1225	415.4267	322.5339	224.5602	232.9422	315.7176	337.6088	317.9704	310.9843	(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	914.8621	886.5096	803.2915	671.4715	517.8239	348.2450	229.5718	240.9876	375.1093	566.9850	754.2364	912.1130	(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	436.6152	344.8389	291.6383	169.4513	76.1835	0.0000	0.0000	0.0000	0.0000	170.6560	314.1116	447.2398	(98)
Space heating												2250.7345	(98)
Space heating per m2												39.9066	(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	570.4026	449.0403	460.4818	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8640	0.9199	0.8972	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	492.8146	413.0852	413.1654	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	649.4901	621.0207	582.9737	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	112.8063	154.7040	126.3374	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												393.8478 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												
Space cooling per m2												98.4619 (107)
Energy for space heating												1.7458 (108)
Energy for space cooling												39.9066 (99)
Total												1.7458 (108)
Dwelling Fabric Energy Efficiency (DFEE)												41.6524 (109)
												41.7 (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	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1484 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3984 (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) =		0.3386 (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												
Effective ac	0.4317	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3809	0.3979 (22b)
	0.5932	0.5896	0.5860	0.5694	0.5663	0.5517	0.5517	0.5491	0.5573	0.5663	0.5726	0.5792 (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)			7.9600	1.3258	10.5530		(27)					
Jetfloor Grey			56.4000	0.1300	7.3320		(28a)					
External Wall	34.1200	7.9600	26.1600	0.1800	4.7088		(29a)					
External Wall to Stairwell	20.2500	2.1200	18.1300	0.1800	3.2634		(29a)					
Total net area of external elements Aum(A, m2)			110.7700				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.9772		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5861 (36)					
Total fabric heat loss							(33) + (36) = 35.5633 (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	26.3870	26.2261	26.0683	25.3271	25.1884	24.5429	24.5429	24.4234	24.7916	25.1884	25.4690	25.7622 (38)
Average = Sum(39)m / 12 =	61.9504	61.7894	61.6316	60.8904	60.7518	60.1062	60.1062	59.9867	60.3549	60.7518	61.0323	61.3256 (39)
	60.8898 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0984	1.0956	1.0928	1.0796	1.0772	1.0657	1.0657	1.0636	1.0701	1.0772	1.0821	1.0873 (40)
Days in month												1.0796 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m = 1239.9620 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.3185	23.8929	24.6553	21.4951	20.6251	17.7979	16.4924	18.9252	19.1512	22.3189	24.3629	26.4565	(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	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	36.7184	35.5549	33.1389	29.8543	27.7219	24.7193	22.1671	25.4371	26.5990	29.9986	33.8373	35.5598	(72)
Total internal gains	267.3149	266.1026	256.8100	241.6637	225.8626	211.0470	201.7028	205.0216	213.0600	228.3214	245.8288	259.3643	(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)							
Southwest	3.9700	36.7938	0.6300	0.7000	0.7700	44.6414 (79)							
Solar gains	58.3997	104.0463	154.4994	211.7785	255.7807	262.0998	249.2927	215.2162	174.1386	118.2662	70.7816	49.4395	(83)
Total gains	325.7146	370.1489	411.3094	453.4422	481.6433	473.1468	450.9956	420.2379	387.1986	346.5877	316.6105	308.8037	(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)	63.2227	63.3874	63.5497	64.3232	64.4700	65.1624	65.1624	65.2923	64.8939	64.4700	64.1737	63.8668	21.0000 (85)
tau	5.2148	5.2258	5.2366	5.2882	5.2980	5.3442	5.3442	5.3528	5.3263	5.2980	5.2782	5.2578	
alpha	0.9983	0.9964	0.9906	0.9690	0.9001	0.7442	0.5719	0.6311	0.8709	0.9808	0.9965	0.9988	(86)
util living area	19.8075	19.9472	20.1819	20.4984	20.7782	20.9450	20.9890	20.9819	20.8661	20.5074	20.1016	19.7841	(87)
MIT	20.0021	20.0045	20.0068	20.0175	20.0195	20.0289	20.0289	20.0307	20.0253	20.0195	20.0155	20.0112	(88)
Th 2	0.9978	0.9952	0.9872	0.9569	0.8608	0.6572	0.4532	0.5107	0.8067	0.9711	0.9951	0.9983	(89)
util rest of house	18.9133	19.0543	19.2893	19.6075	19.8662	20.0030	20.0260	20.0253	19.9488	19.6218	19.2176	18.8972	(90)
MIT 2	19.2550	19.3955	19.6303	19.9479	20.2147	20.3629	20.3940	20.3908	20.2993	19.9602	19.5554	19.2361	(91)
Living area fraction	19.2550	19.3955	19.6303	19.9479	20.2147	20.3629	20.3940	20.3908	20.2993	19.9602	19.5554	19.2361	(92)
MIT	19.2550	19.3955	19.6303	19.9479	20.2147	20.3629	20.3940	20.3908	20.2993	19.9602	19.5554	19.2361	(93)
Temperature adjustment													0.0000
adjusted MIT	19.2550	19.3955	19.6303	19.9479	20.2147	20.3629	20.3940	20.3908	20.2993	19.9602	19.5554	19.2361	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9942	0.9856	0.9558	0.8696	0.6891	0.4990	0.5573	0.8272	0.9703	0.9942	0.9979	(94)
Useful gains	324.8071	367.9958	405.3771	433.4098	418.8604	326.0436	225.0543	234.1824	320.2744	336.3109	314.7885	308.1505	(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	926.4649	895.6669	809.2427	672.7115	517.2812	346.3857	228.0404	239.3961	374.1577	568.6482	760.1821	922.0973	(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	447.6334	354.5950	300.4760	172.2972	73.2251	0.0000	0.0000	0.0000	0.0000	172.8589	320.6834	456.7765	(98)
Space heating												2298.5456	(98)
Space heating per m2												40.7544	(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	564.9987	444.7862	455.8989	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8810	0.9373	0.9162	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	497.7714	416.9144	417.7050	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	623.9416	596.7206	561.9952	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	90.8426	133.7758	107.3519	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													331.9703
Cooled fraction													1.0000
Intermittency factor (Table 10b)													1.0000

fc = cooled area / (4) =

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	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	22.7106	33.4440	26.8380	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												82.9926 (107)
Energy for space heating												1.4715 (108)
Energy for space cooling												40.7544 (99)
Total												1.4715 (108)
Target Fabric Energy Efficiency (TFEE)												42.2259 (109)
												48.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	2.3900 (2b)	134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	134.7960 (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 (25)
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)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	34.1200	7.9600	26.1600	0.2500	6.5400	52.8000	1381.2480 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			110.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.4686		(33)
AAC Party Wall			24.9900	0.0000	0.0000	52.8000	1319.4720 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2111 (36)
Total fabric heat loss							(33) + (36) = 36.6797 (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	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413 (38)
Heat transfer coeff	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210 (39)
Average = Sum(39)m / 12 =												58.9210 (39)
HLP	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447 (40)
HLP (average)												1.0447 (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	1.8782 (42)											
Average daily hot water use (litres/day)	78.8083 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m														
	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752	18.6752 (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	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)	
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156	14.0156 (61)	
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	138.5167 (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 (63)	
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	138.5167 (64)	
RHI water heating demand													Total per year (kWh/year) = Sum(64)m =	1404.3028 (64)
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005	44.9005 (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	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126	422.9126 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast		3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Southwest		1.4500	40.9830	0.4300	0.0000	0.7700	19.6757 (79)						
Southwest		2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (79)						
Solar gains	70.9744	118.0344	172.7456	249.5228	291.2205	311.0919	292.9423	254.6442	206.6368	140.3387	88.1648	59.4819	59.4819 (83)
Total gains	505.4022	548.8014	586.8470	638.0061	653.7838	650.3142	618.4666	587.1282	553.8202	513.3202	489.7406	482.3945	482.3945 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496
alpha	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233
util living area	0.9831	0.9730	0.9446	0.8635	0.7110	0.5001	0.3233	0.3404	0.6148	0.8771	0.9660	0.9862	0.9862 (86)
MIT	20.1821	20.2995	20.5226	20.7764	20.9365	20.9916	20.9993	20.9992	20.9770	20.7964	20.4520	20.1447	20.1447 (87)
Th 2	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463 (88)
util rest of house	0.9783	0.9655	0.9290	0.8280	0.6481	0.4183	0.2330	0.2454	0.5270	0.8361	0.9548	0.9821	0.9821 (89)
MIT 2	18.9872	19.1548	19.4686	19.8056	19.9923	20.0418	20.0461	20.0461	20.0321	19.8388	19.3746	18.9338	18.9338 (90)
Living area fraction													FLA = Living area / (4) =
MIT	19.4437	19.5922	19.8713	20.1766	20.3531	20.4047	20.4103	20.4102	20.3931	20.2047	19.7863	19.3965	19.3965 (92)
Temperature adjustment													0.0000
adjusted MIT	19.4437	19.5922	19.8713	20.1766	20.3531	20.4047	20.4103	20.4102	20.3931	20.2047	19.7863	19.3965	19.3965 (93)

8. Space heating requirement

Utilisation	0.9744	0.9611	0.9257	0.8333	0.6693	0.4494	0.2675	0.2817	0.5599	0.8437	0.9511	0.9786	0.9786 (94)
Useful gains	492.4754	527.4302	543.2264	531.6755	437.5547	292.2728	165.4632	165.4219	310.0874	433.0998	465.7694	472.0639	472.0639 (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	4.7000 (96)
Heat loss rate W	868.7154	848.0050	758.3910	629.0747	462.7108	294.8813	165.5875	165.5819	317.7699	518.7827	712.1367	865.9312	865.9312 (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	279.9226	215.4263	160.0825	70.1274	18.7161	0.0000	0.0000	0.0000	0.0000	63.7480	177.3845	293.0373	293.0373 (98)
Space heating													1278.4447 (98)
RHI space heating demand													1278 (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	56.4000 (1b)	2.3900 (2b)	134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	134.7960 (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	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:												
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)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	34.1200	7.9600	26.1600	0.2500	6.5400	52.8000	1381.2480 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			110.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.4686		(33)
AAC Party Wall			24.9900	0.0000	0.0000	52.8000	1319.4720 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2111 (36)
Total fabric heat loss							(33) + (36) = 36.6797 (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	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413 (38)
Heat transfer coeff	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210 (39)
Average = Sum(39)m / 12 =												58.9210 (39)
HLP	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447 (40)
HLP (average)												1.0447 (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	1.8782 (42)											
Average daily hot water use (litres/day)	78.8083 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m														
	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752	18.6752 (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	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)	
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156	14.0156 (61)	
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	138.5167 (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 (63)	
													Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	138.5167 (64)	
													Total per year (kWh/year) = Sum(64)m =	1404.3028 (64)
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005	44.9005 (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	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126	422.9126 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g 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)							
Southwest	1.4500	36.7938	0.4300	0.0000	0.7700	17.6645 (79)							
Southwest	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)							
Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625	53.5625 (83)
Total gains	497.6979	543.4904	581.4855	617.9233	639.6752	623.1803	595.6071	565.6485	535.8444	501.1107	478.2604	476.4752	476.4752 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496 (86)
alpha	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233 (86)
util living area	0.9857	0.9760	0.9529	0.8929	0.7681	0.5870	0.4321	0.4738	0.7060	0.9108	0.9740	0.9885	0.9885 (86)
MIT	20.1294	20.2621	20.4702	20.7155	20.9001	20.9801	20.9966	20.9946	20.9501	20.7240	20.3768	20.0844	20.0844 (87)
Th 2	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463 (88)
util rest of house	0.9817	0.9693	0.9397	0.8638	0.7129	0.5070	0.3401	0.3783	0.6274	0.8799	0.9656	0.9852	0.9852 (89)
MIT 2	18.9112	19.1013	19.3956	19.7283	19.9538	20.0335	20.0450	20.0441	20.0096	19.7474	19.2683	18.8464	18.8464 (90)
Living area fraction	19.3766	19.5448	19.8062	20.1055	20.3154	20.3952	20.4086	20.4073	20.3690	20.1206	19.6918	19.3194	19.3194 (92)
Temperature adjustment												0.0000	0.0000 (91)
adjusted MIT	19.3766	19.5448	19.8062	20.1055	20.3154	20.3952	20.4086	20.4073	20.3690	20.1206	19.6918	19.3194	19.3194 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9781	0.9649	0.9358	0.8658	0.7294	0.5370	0.3753	0.4149	0.6553	0.8827	0.9616	0.9819	0.9819 (94)
Ext temp.	486.7862	524.4315	544.1347	534.9783	466.5694	334.6306	223.5513	234.6710	351.1359	442.3228	459.9158	467.8643	467.8643 (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	4.2000 (96)
Month fracti	888.3315	862.8866	784.0152	660.2411	507.6281	341.4574	224.4071	236.1114	369.3736	560.9617	741.9243	890.8521	890.8521 (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	1.0000 (97a)
Space heating	298.7497	227.4418	178.4711	90.1892	30.5477	0.0000	0.0000	0.0000	0.0000	88.2673	203.0461	314.7029	314.7029 (98)
Space heating per m2												(98) / (4) =	25.3797 (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													1530.9261 (211)
Space heating requirement	298.7497	227.4418	178.4711	90.1892	30.5477	0.0000	0.0000	0.0000	0.0000	88.2673	203.0461	314.7029	(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)	319.5184	243.2533	190.8782	96.4591	32.6713	0.0000	0.0000	0.0000	0.0000	94.4036	217.1616	336.5807	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.4408	89.3380	89.1232	88.6806	87.9714	87.3000	87.3000	87.3000	87.3000	88.6347	89.2341	89.4974	(217)
Fuel for water heating, kWh/month	159.4144	140.0164	145.8717	129.2885	126.1642	111.3518	104.8107	117.9550	118.6751	134.2470	143.6573	154.7718	(219)
Water heating fuel used													1586.2241 (219)
Annual totals kWh/year													
Space heating fuel - main system													1530.9261 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)													
mechanical ventilation fans (SFP = 0.2398)													39.4399 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.4399 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													3507.7511 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1530.9261	3.4800	53.2762	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1586.2241	3.4800	55.2006	(247)
Mechanical ventilation fans	39.4399	13.1900	5.2021	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	276.1610	13.1900	36.4256	(250)
Additional standing charges			120.0000	(251)
Total energy cost			279.9971	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.1598 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	83.8215
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1530.9261	0.2160	330.6800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1586.2241	0.2160	342.6244	(264)
Space and water heating			673.3044	(265)
Pumps and fans	114.4399	0.5190	59.3943	(267)
Energy for lighting	276.1610	0.5190	143.3275	(268)
Total kg/year			876.0263	(272)
CO2 emissions per m2			15.5300	(273)
EI value			88.4233	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8843 = 3.935$, stars = 4
Water heating environmental impact	$0.216 / 0.8843 = 0.2443$, stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (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:												
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)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	34.1200	7.9600	26.1600	0.2500	6.5400	52.8000	1381.2480 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			110.7700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.4686		(33)
AAC Party Wall			24.9900	0.0000	0.0000	52.8000	1319.4720 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2111 (36)
Total fabric heat loss							(33) + (36) = 36.6797 (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	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413 (38)
Heat transfer coeff	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210	58.9210 (39)
Average = Sum(39)m / 12 =												58.9210 (39)
HLP	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447	1.0447 (40)
HLP (average)												1.0447 (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	1.8782 (42)											
Average daily hot water use (litres/day)	78.8083 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)													Total = Sum(45)m =	1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m														
	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752	18.6752 (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	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)	
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156	14.0156 (61)	
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	138.5167 (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 (63)	
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	138.5167 (64)	
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005	44.9005 (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	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126	422.9126 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast		3.9900	12.9465	0.4300	0.0000	0.7700	17.1035	17.1035 (75)					
Southwest		1.4500	40.9830	0.4300	0.0000	0.7700	19.6757	19.6757 (79)					
Southwest		2.5200	40.9830	0.4300	0.0000	0.7700	34.1951	34.1951 (79)					
Solar gains	70.9744	118.0344	172.7456	249.5228	311.0919	292.9423	254.6442	206.6368	140.3387	88.1648	59.4819	59.4819 (83)	
Total gains	505.4022	548.8014	586.8470	638.0061	653.7838	650.3142	618.4666	587.1282	553.8202	513.3202	489.7406	482.3945	482.3945 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496	63.3496 (86)
alpha	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233	5.2233 (86)
util living area	0.9831	0.9730	0.9446	0.8635	0.7110	0.5001	0.3233	0.3404	0.6148	0.8771	0.9660	0.9862	0.9862 (86)
MIT	20.1821	20.2995	20.5226	20.7764	20.9365	20.9916	20.9993	20.9992	20.9770	20.7964	20.4520	20.1447	20.1447 (87)
Th 2	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463	20.0463 (88)
util rest of house	0.9783	0.9655	0.9290	0.8280	0.6481	0.4183	0.2330	0.2454	0.5270	0.8361	0.9548	0.9821	0.9821 (89)
MIT 2	18.9872	19.1548	19.4686	19.8056	19.9923	20.0418	20.0461	20.0461	20.0321	19.8388	19.3746	18.9338	18.9338 (90)
Living area fraction	19.4437	19.5922	19.8713	20.1766	20.3531	20.4047	20.4103	20.4102	20.3931	20.2047	19.7863	19.3965	19.3965 (92)
Temperature adjustment												0.0000	0.0000 (91)
adjusted MIT	19.4437	19.5922	19.8713	20.1766	20.3531	20.4047	20.4103	20.4102	20.3931	20.2047	19.7863	19.3965	19.3965 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	492.4754	527.4302	543.2264	531.6755	437.5547	292.2728	165.4632	165.4219	310.0874	433.0998	465.7694	472.0639	472.0639 (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	4.7000 (96)
Heat loss rate W	868.7154	848.0050	758.3910	629.0747	462.7108	294.8813	165.5875	165.5819	317.7699	518.7827	712.1367	865.9312	865.9312 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	279.9226	215.4263	160.0825	70.1274	18.7161	0.0000	0.0000	0.0000	0.0000	63.7480	177.3845	293.0373	293.0373 (98)
Space heating												1278.4447	1278.4447 (98)
Space heating per m2												22.6675	22.6675 (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													1367.3206 (211)
Space heating requirement	279.9226	215.4263	160.0825	70.1274	18.7161	0.0000	0.0000	0.0000	0.0000	63.7480	177.3845	293.0373	(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)	299.3825	230.4024	171.2113	75.0026	20.0173	0.0000	0.0000	0.0000	0.0000	68.1797	189.7160	313.4089	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.3942	89.2976	89.0374	88.4874	87.7477	87.3000	87.3000	87.3000	87.3000	88.3903	89.1294	89.4476	(216)
Fuel for water heating, kWh/month	159.4976	140.0799	146.0124	129.5707	126.4858	111.3518	104.8107	117.9550	118.6751	134.6182	143.8261	154.8579	(219)
Water heating fuel used													1587.7412 (219)
Annual totals kWh/year													
Space heating fuel - main system													1367.3206 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)													
mechanical ventilation fans (SFP = 0.2398)													39.4399 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.4399 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													3345.6626 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1367.3206	3.9200	53.5990 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1587.7412	3.9200	62.2395 (247)
Mechanical ventilation fans	39.4399	16.9600	6.6890 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	276.1610	16.9600	46.8369 (250)
Additional standing charges			88.0000 (251)
Total energy cost			270.0843 (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	1367.3206	0.2160	295.3412 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1587.7412	0.2160	342.9521 (264)
Space and water heating			638.2933 (265)
Pumps and fans	114.4399	0.5190	59.3943 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total kg/year			841.0152 (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	1367.3206	1.2200	1668.1311 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1587.7412	1.2200	1937.0442 (264)
Space and water heating			3605.1753 (265)
Pumps and fans	114.4399	3.0700	351.3305 (267)
Energy for lighting	276.1610	3.0700	847.8142 (268)
Primary energy kWh/year			4804.3200 (272)
Primary energy kWh/m2/year			85.1830 (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 84
 Current environmental impact rating: B 88

(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
---------------------------------	------------	-------------	------------

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

Potential energy efficiency rating: B 84
 Potential environmental impact rating: B 88

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	£66	£66	£0
Mains gas	£204	£204	£0
Space heating	£161	£161	£0
Water heating	£62	£62	£0
Lighting	£47	£47	£0
Total cost of fuels	£270	£270	£0
Total cost of uses	£270	£270	£0
Delivered energy	59 kWh/m ²	59 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	85 kWh/m ²	85 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	Yes
SAP Region	East Anglia
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	238.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	133.45 (P1)
Transmission heat loss coefficient	36.68 (37)
Summer heat loss coefficient	170.13 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South 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)
South 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
South West	1.4500	122.3147	0.4300	0.0000	0.9000	68.6369
South West	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862

total: 342.4001

	Jun	Jul	Aug
Solar gains	364	342	298
Internal gains	336	323	329
Total summer gains	700	665	627

	4.11	3.91	3.69
Summer gain/loss ratio			
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 238.3)	0.33	0.33	0.33
Threshold temperature	19.85	21.84	21.62
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight