

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-001		Issued on Date	30/04/2020	
Assessment Reference	001	Prop Type Ref	GFF Semi		
Property	Plot 001, 1 Bed, K, Ba, Welwyn Garden City				
SAP Rating	83 B	DER	20.13	TER	21.71
Environmental	88 B	% DER<TER	7.27		
CO₂ Emissions (t/year)	0.80	DFEE	48.93	TFEE	54.91
General Requirements Compliance	Pass	% DFEE<TFEE	10.89		
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

Ground-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) 21.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.9 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	1.35 (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 ESPl 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: 2.52 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 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)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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:	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
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.9792		
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =	51.0280 (39)											
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)	1.0878 (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)

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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	13.3405	11.8489	9.6361	7.2952	5.4532	4.6039	4.9746	6.4662	8.6789	11.0199	12.8618	13.7112 (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	259.8796	258.1600	248.8366	234.0292	219.3417	204.9868	195.5526	200.2940	207.8165	222.7887	239.9257	252.4447 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	Specific data	Access	Gains						
	m2	Table 6a	g	FF	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.9900	11.2829	0.2800	0.0000	0.7700	9.7061 (75)						
Northwest	2.5200	11.2829	0.2800	0.0000	0.7700	6.1302 (81)						
Solar gains	15.8362	32.2351	58.0774	95.3798	128.2092	136.6846	127.8656	101.9360	70.7683	39.3939	19.9261	12.9327 (83)
Total gains	275.7158	290.3951	306.9140	329.4090	347.5510	341.6714	323.4183	302.2300	278.5847	262.1826	259.8518	265.3774 (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	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589
alpha	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839
util living area	0.9978	0.9967	0.9933	0.9804	0.9354	0.8162	0.6570	0.7155	0.9164	0.9858	0.9961	0.9982 (86)
MIT	19.7924	19.8865	20.0896	20.3838	20.6872	20.9002	20.9748	20.9613	20.7974	20.4303	20.0574	19.7604 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9971	0.9956	0.9909	0.9725	0.9065	0.7358	0.5272	0.5894	0.8669	0.9785	0.9946	0.9976 (89)
MIT 2	18.3963	18.5337	18.8298	19.2549	19.6767	19.9352	20.0000	19.9921	19.8266	19.3253	18.7837	18.3495 (90)
Living area fraction	18.9909	19.1099	19.3664	19.7357	20.1071	20.3462	20.4152	20.4049	20.2401	19.7959	19.3262	0.4259 (91)
Temperature adjustment	18.9909	19.1099	19.3664	19.7357	20.1071	20.3462	20.4152	20.4049	20.2401	19.7959	19.3262	18.9504 (92)
adjusted MIT	18.9909	19.1099	19.3664	19.7357	20.1071	20.3462	20.4152	20.4049	20.2401	19.7959	19.3262	18.9504 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9961	0.9943	0.9887	0.9697	0.9099	0.7658	0.5829	0.6432	0.8806	0.9764	0.9932	0.9968 (94)
Ext temp.	274.6347	288.7277	303.4572	319.4126	316.2242	261.6636	188.5326	194.3880	245.3108	256.0044	258.0773	264.5182 (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	749.6489	725.1011	656.5464	552.9263	428.9972	293.2158	194.6820	204.3630	313.3179	469.2507	623.8796	752.6843 (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	353.4106	293.2430	262.6984	168.1298	83.9031	0.0000	0.0000	0.0000	0.0000	158.6553	263.3776	363.1956 (98)
											1946.6132 (98)	
											(98) / (4) =	41.4968 (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

	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													2081.9393 (211)
Space heating requirement	353.4106	293.2430	262.6984	168.1298	83.9031	0.0000	0.0000	0.0000	0.0000	158.6553	263.3776	363.1956	(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)	377.9792	313.6288	280.9608	179.8180	89.7359	0.0000	0.0000	0.0000	0.0000	169.6848	281.6873	388.4445	(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	89.6081	89.5716	89.4703	89.2343	88.7095	87.3000	87.3000	87.3000	87.3000	89.1608	89.4820	89.6436	(217)
Fuel for water heating, kWh/month	147.0244	129.0724	134.3785	118.9358	115.8975	103.2711	97.3228	109.3613	109.9774	123.5287	132.4615	142.8130	(219)
Water heating fuel used													1464.0444 (219)
Annual totals kWh/year													
Space heating fuel - main system													2081.9393 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													235.5965 (232)
Total delivered energy for all uses													3889.6875 (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	2081.9393	0.2160	449.6989	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1464.0444	0.2160	316.2336	(264)
Space and water heating			765.9325	(265)
Pumps and fans	108.1073	0.5190	56.1077	(267)
Energy for lighting	235.5965	0.5190	122.2746	(268)
Total CO2, kg/year			944.3148	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.1300	(273)

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

DER		20.1300	ZC1
Total Floor Area		46.9100	TFA
Assumed number of occupants		1.5997	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		17.5861	ZC2
CO2 emissions from cooking, equation (L16)		3.3552	ZC3
Total CO2 emissions		41.0713	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		41.0713	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4284 (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) =	0.3641 (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	0.4643	0.4552	0.4461	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4279 (22b)
	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (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)			6.5100	1.3258	8.6307		(27)					
Jetfloor Grey			46.9100	0.1300	6.0983		(28a)					
External Wall	34.9900	8.6300	26.3600	0.1800	4.7448		(29a)					
External Wall to Corridor	3.6000		3.6000	0.1800	0.6480		(29a)					
External Wall to Stairwell	11.9300		11.9300	0.1800	2.1474		(29a)					
Total net area of external elements Aum(A, m2)			97.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.3892	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1336 (36)					
Total fabric heat loss						(33) + (36) =	31.5228 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	22.4863	22.3314	22.1797	21.4668	21.3335	20.7126	20.7126	20.5976	20.9517	21.3335	21.6033	21.8853 (38)
Heat transfer coeff	54.0091	53.8542	53.7025	52.9896	52.8562	52.2354	52.2354	52.1204	52.4745	52.8562	53.1261	53.4081 (39)
Average = Sum(39)m / 12 =												52.9890 (39)
HLP	1.1513	1.1480	1.1448	1.1296	1.1268	1.1135	1.1135	1.1111	1.1186	1.1268	1.1325	1.1385 (40)
HLP (average)												1.1296 (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)												1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	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)
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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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	(57)	
	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	(61)	
Total heat required for water heating calculated for each month															
Solar input	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	(62)	
	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															
	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	(64)	
													Total per year (kWh/year) = Sum(64)m =	1568.8969	(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	(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)	
	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														
	13.3405	11.8489	9.6361	7.2952	5.4532	4.6039	4.9746	6.4662	8.6789	11.0199	12.8618	13.7112	(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														
	268.7795	266.5704	256.7599	241.4665	226.2905	211.4483	202.0184	207.2468	215.2597	230.7180	248.3396	261.3470	(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	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)							

Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321	(83)
Total gains	291.2274	312.2637	339.0846	376.6674	408.0271	405.1987	383.2679	351.7410	315.5737	286.5588	276.5848	279.6791	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
	60.3165	60.4899	60.6609	61.4769	61.6321	62.3646	62.3646	62.5022	62.0804	61.6321	61.3190	60.9952	
alpha	5.0211	5.0327	5.0441	5.0985	5.1088	5.1576	5.1576	5.1668	5.1387	5.1088	5.0879	5.0663	
util living area													
	0.9977	0.9962	0.9914	0.9715	0.9034	0.7479	0.5817	0.6486	0.8888	0.9825	0.9958	0.9981	(86)
MIT	19.7762	19.8865	20.1132	20.4469	20.7528	20.9370	20.9861	20.9766	20.8357	20.4609	20.0700	19.7599	(87)
Th 2	19.9591	19.9618	19.9644	19.9767	19.9790	19.9898	19.9898	19.9918	19.9857	19.9790	19.9744	19.9695	(88)
util rest of house													
	0.9969	0.9949	0.9882	0.9600	0.8641	0.6585	0.4573	0.5225	0.8279	0.9734	0.9940	0.9975	(89)
MIT 2	18.3309	18.4938	18.8257	19.3135	19.7287	19.9464	19.9845	19.9817	19.8454	19.3406	18.7711	18.3144	(90)
Living area fraction													
	fLA = Living area / (4) = 0.4259 (91)												
MIT	18.9465	19.0870	19.3741	19.7962	20.1649	20.3683	20.4111	20.4054	20.2672	19.8177	19.3244	18.9301	(92)
Temperature adjustment													
	0.0000												
adjusted MIT	18.9465	19.0870	19.3741	19.7962	20.1649	20.3683	20.4111	20.4054	20.2672	19.8177	19.3244	18.9301	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9958	0.9934	0.9858	0.9575	0.8723	0.6943	0.5108	0.5765	0.8475	0.9715	0.9925	0.9966	(94)
Useful gains	290.0058	310.2095	334.2680	360.6491	355.9176	281.3220	195.7548	202.7953	267.4333	278.3997	274.5094	278.7216	(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													
	791.0437	764.0294	691.3694	577.3866	447.4217	301.3109	199.0759	208.7632	323.6198	487.2155	649.4318	786.7077	(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													
	372.7722	304.9670	265.6835	156.0510	68.0791	0.0000	0.0000	0.0000	0.0000	155.3589	269.9442	377.9417	(98)
Space heating													
	1970.7975 (98)												
Space heating per m2													
	(98) / (4) = 42.0123 (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

	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													2110.0616 (211)
Space heating requirement	372.7722	304.9670	265.6835	156.0510	68.0791	0.0000	0.0000	0.0000	0.0000	155.3589	269.9442	377.9417	(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)	399.1137	326.5171	284.4577	167.0782	72.8898	0.0000	0.0000	0.0000	0.0000	166.3372	289.0194	404.6485	(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	87.1342	86.9877	86.5758	85.5599	83.6201	80.3000	80.3000	80.3000	80.3000	85.4293	86.6308	87.2166	(217)
Fuel for water heating, kWh/month	181.5956	158.8955	166.1071	149.0778	147.6820	135.4479	129.7694	144.6625	146.2601	156.5467	164.7927	177.1635	(219)
Water heating fuel used													1858.0008 (219)
Annual totals kWh/year													
Space heating fuel - main system													2110.0616 (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)													235.5965 (232)
Total delivered energy for all uses													4278.6590 (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	2110.0616	0.2160	455.7733 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1858.0008	0.2160	401.3282 (264)
Space and water heating			857.1015 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	235.5965	0.5190	122.2746 (268)
Total CO2, kg/m2/year			1018.3011 (272)
Emissions per m2 for space and water heating			18.2712 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6066 (272b)
Emissions per m2 for pumps and fans			0.8298 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.2712 * 1.00) + 2.6066 + 0.8298, rounded to 2 d.p.			21.7100 (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 2.3900 (2b)	= 112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3784	(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) =		0.3216 (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	0.4101	0.4020	0.3940	0.3538	0.3458	0.3055	0.3055	0.2975	0.3216	0.3458	0.3618	0.3779 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.9792		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			30.0000	1407.3000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				9376.9220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss			(33) + (36) =				32.5291 (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	21.6098	21.4890	21.3706	20.8145	20.7104	20.2260	20.2260	20.1363	20.4126	20.7104	20.9209	21.1410 (38)
Average = Sum(39)m / 12 =	54.1389	54.0181	53.8997	53.3435	53.2395	52.7551	52.7551	52.6654	52.9417	53.2395	53.4500	53.6701 (39)
												53.3430 (39)
HLP	1.1541	1.1515	1.1490	1.1371	1.1349	1.1246	1.1246	1.1227	1.1286	1.1349	1.1394	1.1441 (40)
HLP (average)												1.1371 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	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	13.3405	11.8489	9.6361	7.2952	5.4532	4.6039	4.9746	6.4662	8.6789	11.0199	12.8618	13.7112	(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	233.1874	232.0746	224.0083	210.9085	197.3301	184.5356	176.4259	179.4683	186.3857	199.5909	214.7323	226.3542	(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	0.2800		0.0000		0.7700	9.7061 (75)					
Northwest	2.5200	11.2829	0.2800		0.0000		0.7700	6.1302 (81)					
Solar gains	15.8362	32.2351	58.0774	95.3798	128.2092	136.6846	127.8656	101.9360	70.7683	39.3939	19.9261	12.9327	(83)
Total gains	249.0236	264.3098	282.0857	306.2884	325.5394	321.2202	304.2915	281.4043	257.1540	238.9848	234.6584	239.2869	(84)

7. Mean internal temperature (heating season)

Utilisation during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	48.1114	48.2190	48.3250	48.8288	48.9242	49.3734	49.3734	49.4575	49.1994	48.9242	48.7315	48.5317	
alpha	4.2074	4.2146	4.2217	4.2553	4.2616	4.2916	4.2916	4.2972	4.2800	4.2616	4.2488	4.2354	
util living area	0.9968	0.9954	0.9913	0.9775	0.9355	0.8307	0.6885	0.7460	0.9219	0.9840	0.9949	0.9973	(86)
MIT	19.4410	19.5574	19.8057	20.1744	20.5452	20.8306	20.9459	20.9226	20.6935	20.2397	19.7851	19.4207	(87)
Th 2	19.9569	19.9590	19.9610	19.9706	19.9724	19.9808	19.9808	19.9823	19.9776	19.9724	19.9688	19.9650	(88)
util rest of house	0.9959	0.9941	0.9886	0.9696	0.9096	0.7578	0.5601	0.6254	0.8790	0.9769	0.9931	0.9966	(89)
MIT 2	18.5316	18.6493	18.8981	19.2702	19.6280	19.8840	19.9618	19.9520	19.7741	19.3387	18.8844	18.5176	(90)
Living area fraction										fLA = Living area / (4) =			
MIT	18.9189	19.0360	19.2847	19.6554	20.0186	20.2872	20.3810	20.3654	20.1657	19.7225	19.2680	18.9022	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9189	19.0360	19.2847	19.6554	20.0186	20.2872	20.3810	20.3654	20.1657	19.7225	19.2680	18.9022	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9925	0.9863	0.9665	0.9110	0.7824	0.6142	0.6752	0.8885	0.9747	0.9916	0.9955	(94)
Useful gains	247.7044	262.3263	278.2109	296.0291	296.5742	251.3092	186.9037	190.0104	228.4886	232.9281	232.6765	238.2202	(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	791.4539	763.6024	689.0908	573.7293	442.8800	300.0292	199.4648	208.8402	321.1286	485.6748	650.3801	789.0692	(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	404.5496	336.8576	305.6946	199.9442	108.8515	0.0000	0.0000	0.0000	0.0000	188.0436	300.7465	409.8317	(98)
Space heating												2254.5193	(98)
Space heating per m2												48.0605	(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	495.8980	390.3878	400.2570	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7562	0.8357	0.8006	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	375.0138	326.2494	320.4638	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	436.7219	415.8350	390.0958	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	44.4298	66.6517	51.8062	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												162.8878 (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	0.0000	0.0000	0.0000	0.0000	0.0000	11.1075	16.6629	12.9516	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												40.7219 (107)
Energy for space cooling												0.8681 (108)
Total												48.0605 (99)
Dwelling Fabric Energy Efficiency (DFEE)												0.8681 (108)
												48.9286 (109)
												48.9 (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)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4284 (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) =	0.3641 (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	0.4643	0.4552	0.4461	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4279 (22b)
Effective ac	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (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)			6.5100	1.3258	8.6307		(27)					
Jetfloor Grey			46.9100	0.1300	6.0983		(28a)					
External Wall	34.9900	8.6300	26.3600	0.1800	4.7448		(29a)					
External Wall to Corridor	3.6000		3.6000	0.1800	0.6480		(29a)					
External Wall to Stairwell	11.9300		11.9300	0.1800	2.1474		(29a)					
Total net area of external elements Aum(A, m2)			97.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.3892	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1336 (36)					
Total fabric heat loss						(33) + (36) =	31.5228 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	22.4863	22.3314	22.1797	21.4668	21.3335	20.7126	20.7126	20.5976	20.9517	21.3335	21.6033	21.8853 (38)
Heat transfer coeff	54.0091	53.8542	53.7025	52.9896	52.8562	52.2354	52.2354	52.1204	52.4745	52.8562	53.1261	53.4081 (39)
Average = Sum(39)m / 12 =												52.9890 (39)
HLP	1.1513	1.1480	1.1448	1.1296	1.1268	1.1135	1.1135	1.1111	1.1186	1.1268	1.1325	1.1385 (40)
HLP (average)												1.1296 (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												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss												
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 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	15.6794	23.3504	17.0962	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												56.1260 (107)
Space cooling per m2												1.1965 (108)
Energy for space heating												46.5513 (99)
Energy for space cooling												1.1965 (108)
Total												47.7478 (109)
Target Fabric Energy Efficiency (TFEE)												54.9 (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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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	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	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
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.9792		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =												51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	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)
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)
RHI water heating demand												1300 (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)

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	33.3511	29.6222	24.0904	18.2380	13.6331	11.5096	12.4366	16.1655	21.6973	27.5497	32.1546	34.2781 (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	379.6554	376.4100	361.9744	339.8385	317.5696	297.4119	285.5084	291.7756	304.4102	326.7110	351.4295	369.7513 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	12.9465	0.2800	0.0000	0.7700	11.1372 (75)						
Northwest	2.5200	12.9465	0.2800	0.0000	0.7700	7.0340 (81)						
Solar gains	18.1712	34.5956	61.3784	105.6938	136.5956	151.4533	140.4138	113.1903	79.2444	44.2323	23.4518	14.6772 (83)
Total gains	397.8266	411.0055	423.3528	445.5323	454.1652	448.8652	425.9222	404.9659	383.6545	370.9433	374.8812	384.4285 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9876	0.9838	0.9703	0.9270	0.8158	0.6117	0.4048	0.4251	0.7295	0.9276	0.9775	0.9893 (86)
MIT	20.0816	20.1590	20.3646	20.6363	20.8677	20.9766	20.9978	20.9972	20.9449	20.6949	20.3466	20.0553 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9839	0.9789	0.9607	0.9025	0.7576	0.5146	0.2885	0.3033	0.6356	0.8976	0.9695	0.9860 (89)
MIT 2	18.8159	18.9275	19.2225	19.5994	19.8907	19.9977	20.0103	20.0102	19.9745	19.6846	19.1993	18.7780 (90)
Living area fraction	19.3550	19.4520	19.7089	20.0410	20.3068	20.4146	20.4309	20.4306	20.3879	20.1149	19.6880	19.3220 (91)
MIT	19.3550	19.4520	19.7089	20.0410	20.3068	20.4146	20.4309	20.4306	20.3879	20.1149	19.6880	19.3220 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3550	19.4520	19.7089	20.0410	20.3068	20.4146	20.4309	20.4306	20.3879	20.1149	19.6880	19.3220 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9807	0.9753	0.9571	0.9034	0.7764	0.5555	0.3382	0.3555	0.6736	0.9013	0.9662	0.9831 (94)
Ext temp.	390.1373	400.8686	405.1828	402.4935	352.6318	249.3551	144.0634	143.9464	258.4420	334.3258	362.1959	377.9132 (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	747.8140	727.2520	648.5119	537.8872	398.3660	255.8876	144.4552	144.4392	274.9315	444.7054	611.7228	746.1324 (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)
RHI space heating demand	266.1115	219.3296	181.0369	97.4834	34.0263	0.0000	0.0000	0.0000	0.0000	82.1225	179.6594	273.9551 (98)
												1333.7246 (98)
												1334 (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)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9792	(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =												51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
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	33.3511	29.6222	24.0904	18.2380	13.6331	11.5096	12.4366	16.1655	21.6973	27.5497	32.1546	34.2781 (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	379.6554	376.4100	361.9744	339.8385	317.5696	297.4119	285.5084	291.7756	304.4102	326.7110	351.4295	369.7513 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains						
	m2	Table 6a	g		factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.9900	11.2829	0.2800	0.0000	0.7700	9.7061 (75)						
Northwest	2.5200	11.2829	0.2800	0.0000	0.7700	6.1302 (81)						
Solar gains	15.8362	32.2351	58.0774	95.3798	128.2092	136.6846	127.8656	101.9360	70.7683	39.3939	19.9261	12.9327 (83)
Total gains	395.4917	408.6451	420.0519	435.2183	445.7788	434.0965	413.3740	393.7116	375.1784	366.1049	371.3556	382.6839 (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	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589
alpha	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839
util living area	0.9891	0.9854	0.9749	0.9434	0.8606	0.6990	0.5317	0.5781	0.8080	0.9475	0.9819	0.9908 (86)
MIT	20.0353	20.1234	20.3086	20.5671	20.8097	20.9516	20.9901	20.9851	20.8976	20.6154	20.2788	19.9995 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9859	0.9810	0.9669	0.9243	0.8141	0.6113	0.4180	0.4627	0.7332	0.9260	0.9756	0.9880 (89)
MIT 2	18.7487	18.8761	19.1426	19.5060	19.8233	19.9779	20.0070	20.0044	19.9295	19.5780	19.1020	18.6969 (90)
Living area fraction	19.2967	19.4074	19.6392	19.9580	20.2435	20.3926	20.4257	20.4221	20.3418	20.0199	19.6032	0.4259 (91)
Temperature adjustment	19.2967	19.4074	19.6392	19.9580	20.2435	20.3926	20.4257	20.4221	20.3418	20.0199	19.6032	19.2517 (92)
adjusted MIT	19.2967	19.4074	19.6392	19.9580	20.2435	20.3926	20.4257	20.4221	20.3418	20.0199	19.6032	0.0000
												19.2517 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9828	0.9776	0.9632	0.9231	0.8262	0.6468	0.4667	0.5120	0.7605	0.9262	0.9723	0.9853 (94)
Ext temp.	388.7034	399.4713	404.5928	401.7367	368.2953	280.7892	192.9232	201.5894	285.3316	339.0892	361.0652	377.0413 (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	765.2510	740.2832	670.4677	564.2658	435.9561	295.5847	195.2196	205.2398	318.5080	480.6765	638.0135	768.0572 (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	280.1514	229.0256	197.8110	117.0209	5.3397	0.0000	0.0000	0.0000	0.0000	105.3410	199.4028	290.9158 (98)
Space heating per m2												1470.0081 (98)
												(98) / (4) =
												31.3368 (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													1572.2012 (211)
Space heating requirement	280.1514	229.0256	197.8110	117.0209	50.3397	0.0000	0.0000	0.0000	0.0000	105.3410	199.4028	290.9158	(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)	299.6272	244.9471	211.5625	125.1561	53.8392	0.0000	0.0000	0.0000	0.0000	112.6641	213.2650	311.1399	(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	89.4513	89.4007	89.2631	88.9493	88.3266	87.3000	87.3000	87.3000	87.3000	88.8356	89.2799	89.4975	(216)
Fuel for water heating, kWh/month	147.2821	129.3191	134.6904	119.3168	116.4000	103.2711	97.3228	109.3613	109.9774	123.9809	132.7614	143.0462	(219)
Water heating fuel used													1466.7295 (219)
Annual totals kWh/year													
Space heating fuel - main system													1572.2012 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													235.5965 (232)
Total delivered energy for all uses													3382.6346 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1572.2012	3.4800	54.7126 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1466.7295	3.4800	51.0422 (247)
Mechanical ventilation fans	33.1073	13.1900	4.3669 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	235.5965	13.1900	31.0752 (250)
Additional standing charges			120.0000 (251)
Total energy cost			271.0893 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2388 (257)
SAP value		82.7188
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	1572.2012	0.2160	339.5955 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1466.7295	0.2160	316.8136 (264)
Space and water heating			656.4090 (265)
Pumps and fans	108.1073	0.5190	56.1077 (267)
Energy for lighting	235.5965	0.5190	122.2746 (268)
Total kg/year			834.7913 (272)
CO2 emissions per m2			17.8000 (273)
EI value			87.8292
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	$3.48 / 0.8852 = 3.931$, stars = 4
Water heating environmental impact	$0.216 / 0.8852 = 0.2440$, 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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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	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
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			46.9100	0.1500	7.0365	75.0000	3518.2500 (28a)
External Wall	34.9900	8.6300	26.3600	0.2500	6.5900	52.8000	1391.8080 (29a)
External Wall to Corridor	3.6000		3.6000	0.2200	0.7920	52.8000	190.0800 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			97.4300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9792	(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11253.3220 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.8918 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5499 (36)
Total fabric heat loss							(33) + (36) = 32.5291 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280	51.0280 (39)
Average = Sum(39)m / 12 =												51.0280 (39)
HLP	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0878 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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:	0.0000											
Total storage loss	0.0000 (56)											
If cylinder contains dedicated solar storage	0.0000											
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)
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	33.3511	29.6222	24.0904	18.2380	13.6331	11.5096	12.4366	16.1655	21.6973	27.5497	32.1546	34.2781 (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	379.6554	376.4100	361.9744	339.8385	317.5696	297.4119	285.5084	291.7756	304.4102	326.7110	351.4295	369.7513 (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	12.9465	0.2800	0.0000	0.7700	11.1372 (75)						
Northwest	2.5200	12.9465	0.2800	0.0000	0.7700	7.0340 (81)						
Solar gains	18.1712	34.5956	61.3784	105.6938	136.5956	151.4533	140.4138	113.1903	79.2444	44.2323	23.4518	14.6772 (83)
Total gains	397.8266	411.0055	423.3528	445.5323	454.1652	448.8652	425.9222	404.9659	383.6545	370.9433	374.8812	384.4285 (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	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589	61.2589
alpha	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839	5.0839
util living area	0.9876	0.9838	0.9703	0.9270	0.8158	0.6117	0.4048	0.4251	0.7295	0.9276	0.9775	0.9893 (86)
MIT	20.0816	20.1590	20.3646	20.6363	20.8677	20.9766	20.9978	20.9972	20.9449	20.6949	20.3466	20.0553 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9839	0.9789	0.9607	0.9025	0.7576	0.5146	0.2885	0.3033	0.6356	0.8976	0.9695	0.9860 (89)
MIT 2	18.8159	18.9275	19.2225	19.5994	19.8907	19.9977	20.0103	20.0102	19.9745	19.6846	19.1993	18.7780 (90)
Living area fraction	19.3550	19.4520	19.7089	20.0410	20.3068	20.4146	20.4309	20.4306	20.3879	20.1149	19.6880	0.4259 (91)
Temperature adjustment	19.3550	19.4520	19.7089	20.0410	20.3068	20.4146	20.4309	20.4306	20.3879	20.1149	19.6880	19.3220 (92)
adjusted MIT	19.3550	19.4520	19.7089	20.0410	20.3068	20.4146	20.4309	20.4306	20.3879	20.1149	19.6880	0.0000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9807	0.9753	0.9571	0.9034	0.7764	0.5555	0.3382	0.3555	0.6736	0.9013	0.9662	0.9831 (94)
Ext temp.	390.1373	400.8686	405.1828	402.4935	352.6318	249.3551	144.0634	143.9464	258.4420	334.3258	362.1959	377.9132 (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	747.8140	727.2520	648.5119	537.8872	398.3660	255.8876	144.4552	144.4392	274.9315	444.7054	611.7228	746.1324 (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	266.1115	219.3296	181.0369	97.4834	34.0263	0.0000	0.0000	0.0000	0.0000	82.1225	179.6594	273.9551 (98)
Space heating per m2	(98) / (4) = 28.4316 (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													1426.4434 (211)
Space heating requirement	266.1115	219.3296	181.0369	97.4834	34.0263	0.0000	0.0000	0.0000	0.0000	82.1225	179.6594	273.9551	(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)	284.6112	234.5771	193.6223	104.2604	36.3917	0.0000	0.0000	0.0000	0.0000	87.8315	192.1491	293.0001	(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	89.4147	89.3693	89.1952	88.8033	88.0744	87.3000	87.3000	87.3000	87.3000	88.6387	89.2003	89.4557	(216)
Fuel for water heating, kWh/month	147.3423	129.3646	134.7929	119.5130	116.7333	103.2711	97.3228	109.3613	109.9774	124.2563	132.8799	143.1130	(219)
Water heating fuel used													1467.9279 (219)
Annual totals kWh/year													
Space heating fuel - main system													1426.4434 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													235.5965 (232)
Total delivered energy for all uses													3238.0751 (238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1426.4434	3.9300	56.0592 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1467.9279	3.9300	57.6896 (247)
Mechanical ventilation fans	33.1073	17.5600	5.8136 (249)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	235.5965	17.5600	41.3707 (250)
Additional standing charges			88.0000 (251)
Total energy cost			262.1032 (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	1426.4434	0.2160	308.1118 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1467.9279	0.2160	317.0724 (264)
Space and water heating			625.1842 (265)
Pumps and fans	108.1073	0.5190	56.1077 (267)
Energy for lighting	235.5965	0.5190	122.2746 (268)
Total kg/year			803.5665 (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	1426.4434	1.2200	1740.2609 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1467.9279	1.2200	1790.8720 (264)
Space and water heating			3531.1329 (265)
Pumps and fans	108.1073	3.0700	331.8895 (267)
Energy for lighting	235.5965	3.0700	723.2813 (268)
Primary energy kWh/year			4586.3037 (272)
Primary energy kWh/m2/year			97.7681 (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 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
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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 88

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 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	£60	£60	£0
Mains gas	£202	£202	£0
Space heating	£163	£163	£0
Water heating	£58	£58	£0
Lighting	£41	£41	£0
Total cost of fuels	£262	£262	£0
Total cost of uses	£262	£262	£0
Delivered energy	69 kWh/m ²	69 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	17 kg/m ²	17 kg/m ²	0 kg/m ²
Primary energy	98 kWh/m ²	98 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	North West
Overshading	Average or unknown
Thermal mass parameter	239.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	74.00 (P1)
Transmission heat loss coefficient	32.53 (37)
Summer heat loss coefficient	106.52 (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	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (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	0.2800	0.0000	0.7650	85.5012
North West	2.5200	100.0415	0.2800	0.0000	0.7650	54.0008
total:						139.5020

	Jun	Jul	Aug
Solar gains	150	140	112 (P4)
Internal gains	294	283	289
Total summer gains	445	422	401 (P5)

	4.18	3.96	3.77
Summer gain/loss ratio	4.18	3.96	3.77 (P6)
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 239.9)	0.32	0.32	0.32
Threshold temperature	19.90	21.88	21.69 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight