

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW027b_104_As_Built				Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	MFF			
Property						
SAP Rating	85 B	DER	14.55	TER	16.43	
Environmental	89 B	% DER<TER	11.43			
CO ₂ Emissions (t/year)	0.92	DFEE	31.73	TFEE	38.85	
General Requirements Compliance	Pass	% DFEE<TFEE	18.33			
Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk				Assessor ID	d168-0001
Client	Bellway Homes Thames Valley					

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 74 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) 16.43 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.55 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)38.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)31.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.25 (max. 2.00)	1.30 (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: 3.13 (measured in this dwelling)
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: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.80 m², No overhang
Windows facing East: 6.42 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.1 m³/m²h

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					3.1300
Infiltration rate					0.1565 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1213 (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	0.1546	0.1516	0.1486	0.1334	0.1304	0.1152	0.1152	0.1122	0.1213	0.1304	0.1364	0.1425 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)
WT-E-03	20.1600	10.2200	9.9400	0.1600	1.5904		(29a)
WT-I-02	47.0400	2.1200	44.9200	0.1584	7.1162		(29a)
WT-I-11	3.8400		3.8400	0.2719	1.0441		(29a)
Total net area of external elements Aum(A, m ²)			71.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.5000	(33)
Party Wall 1					22.5600	0.0000	(32)
Party Floor 1					74.2900		(32d)
Party Ceilings 1					74.2900		(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9508 (36)
Total fabric heat loss							(33) + (36) = 32.4508 (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	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188 (38)
Average = Sum(39)m / 12 =	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.8993	95.3029	91.7066	88.1103	84.5139	80.9176	80.9176	84.5139	88.1103	91.7066	95.3029	98.8993 (44)
Energy conte	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Energy content (annual)												Total = Sum(45)m = 1414.6099 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.9997	19.2411	19.8551	17.3101	16.6095	14.3327	13.2814	15.2406	15.4226	17.9736	19.6195	21.3056 (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	14.1047	12.7187	14.0479	13.5568	13.9812	13.4984	13.9285	13.9626	13.5302	14.0203	13.6120	14.0937 (61)
Total heat required for water heating calculated for each month												
	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (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												
	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (64)
								Total per year (kWh/year) = Sum(64)m =				1579.6648 (64)
Heat gains from water heating, kWh/month												
	52.2922	45.8308	47.5241	41.7600	40.3130	35.1455	32.9225	37.2739	37.5693	43.3465	46.8930	50.7507 (65)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8830	17.6599	14.3620	10.8730	8.1277	6.8617	7.4143	9.6374	12.9353	16.4244	19.1697	20.4356	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.0958	209.2448	203.8294	192.3006	177.7476	164.0698	154.9321	152.7831	158.1986	169.7274	184.2804	197.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	(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)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	(71)
Water heating gains (Table 5)	70.2852	68.2005	63.8764	58.0000	54.1841	48.8132	44.2507	50.0994	52.1796	58.2614	65.1291	68.2133	(72)
Total internal gains	358.4483	356.2896	343.2521	322.3579	301.2437	280.9289	267.7815	273.7042	284.4978	305.5974	329.7635	347.7915	(73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.8000	10.6334	0.4500	0.0000	0.7700	14.0010 (74)			
East				6.4200	19.6403	0.4500	0.0000	0.7700	43.6904 (76)			
Solar gains	57.6913	112.2242	186.2190	278.3099	349.9563	362.8517	343.5105	288.6189	218.3664	133.2648	71.7488	47.6007 (83)
Total gains	416.1397	468.5138	529.4711	600.6678	651.2000	643.7807	611.2919	562.3231	502.8642	438.8621	401.5122	395.3922 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542
alpha	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236
util living area												
	0.9675	0.9514	0.9161	0.8395	0.7140	0.5584	0.4265	0.4766	0.6974	0.8844	0.9523	0.9721 (86)
MIT	19.2962	19.5131	19.8867	20.3398	20.7017	20.9014	20.9689	20.9552	20.7942	20.3102	19.7096	19.2301 (87)
Th 2	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250 (88)
util rest of house												
	0.9631	0.9451	0.9050	0.8183	0.6776	0.5036	0.3576	0.4055	0.6466	0.8643	0.9450	0.9683 (89)
MIT 2	18.6459	18.8596	19.2253	19.6599	19.9921	20.1607	20.2096	20.2016	20.0796	19.6409	19.0561	18.5807 (90)
Living area fraction												
	18.9209	19.1360	19.5050	19.9475	20.2922	20.4740	20.5348	20.5203	20.3818	19.9240	19.3325	18.8554 (91)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	18.7709	18.9860	19.3550	19.7975	20.1422	20.3240	20.3808	20.3703	20.2318	19.7740	19.1825	18.7054 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9529	0.9326	0.8903	0.8053	0.6734	0.5109	0.3718	0.4193	0.6471	0.8506	0.9327	0.9589 (94)
Useful gains	396.5254	436.9183	471.3751	483.7096	438.5329	328.9155	227.2719	235.7625	325.3954	373.3017	374.4939	379.1339 (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	895.3097	871.4937	795.3346	674.2219	522.3172	354.1407	233.9139	245.6438	379.3744	567.5895	747.5403	897.4410 (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	371.0955	292.0347	241.0259	137.1689	62.3355	0.0000	0.0000	0.0000	0.0000	144.5501	268.5934	385.6205 (98)
Space heating												1902.4244 (98)
Space heating per m2												(98) / (4) = 25.6081 (99)

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2102.1264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	371.0955	292.0347	241.0259	137.1689	62.3355	0.0000	0.0000	0.0000	0.0000	144.5501	268.5934	385.6205	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	410.0503	322.6903	266.3269	151.5678	68.8790	0.0000	0.0000	0.0000	0.0000	159.7239	296.7883	426.0999	(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	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307	(64)
Efficiency of water heater (217)m	89.5083	89.4326	89.2635	88.9206	88.3410	87.3000	87.3000	87.3000	87.3000	88.9328	89.3548	87.3000	(216)
Fuel for water heating, kWh/month	179.6141	157.6523	164.0257	145.0258	141.1702	124.9140	117.3781	132.3786	133.2733	150.5002	161.6130	174.3426	(219)
Water heating fuel used												1781.8879	(219)
Annual totals kWh/year													
Space heating fuel - main system												2102.1264	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													40.0239 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													115.0239 (231)
Electricity for lighting (calculated in Appendix L)													351.1398 (232)
Total delivered energy for all uses													4350.1780 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	2102.1264	0.2160	454.0593	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1781.8879	0.2160	384.8878	(264)
Space and water heating			838.9471	(265)
Pumps and fans	115.0239	0.5190	59.6974	(267)
Energy for lighting	351.1398	0.5190	182.2416	(268)
Total CO ₂ , kg/year			1080.8861	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5500	(273)

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

DER			14.5500	ZC1
Total Floor Area		TFA	74.2900	
Assumed number of occupants		N	2.3456	
CO ₂ emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO ₂ emissions from appliances, equation (L14)			16.5191	ZC2
CO ₂ emissions from cooking, equation (L16)			2.3596	ZC3
Total CO ₂ emissions			33.4287	ZC4
Residual CO ₂ emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000	ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO ₂ emissions			33.4287	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4183 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3242 (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	0.4133	0.4052	0.3971	0.3566	0.3485	0.3079	0.3079	0.2998	0.3242	0.3485	0.3647	0.3809 (22b)
	0.5854	0.5821	0.5788	0.5636	0.5607	0.5474	0.5474	0.5450	0.5525	0.5607	0.5665	0.5725 (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)			10.2200	1.3258	13.5492		(27)
WT-E-03	20.1600	10.2200	9.9400	0.1800	1.7892		(29a)
WT-I-02	47.0400	2.1200	44.9200	0.1800	8.0856		(29a)
WT-I-11	3.8400		3.8400	0.1800	0.6912		(29a)
Total net area of external elements Aum, m ²			71.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2352		(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)							6.0975 (36)
Total fabric heat loss						(33) + (36) =	32.3327 (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	34.4439	34.2488	34.0575	33.1591	32.9911	32.2086	32.2086	32.0637	32.5100	32.9911	33.3311	33.6866 (38)
Heat transfer coeff	66.7766	66.5815	66.3902	65.4919	65.3238	64.5413	64.5413	64.3965	64.8427	65.3238	65.6638	66.0193 (39)
Average = Sum(39)m / 12 =												65.4911 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8989	0.8962	0.8937	0.8816	0.8793	0.8688	0.8688	0.8668	0.8728	0.8793	0.8839	0.8887 (40)
HLP (average)												0.8816 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	98.8993	95.3029	91.7066	88.1103	84.5139	80.9176	80.9176	84.5139	88.1103	91.7066	95.3029	98.8993 (44)
Energy content (annual)	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9997	19.2411	19.8551	17.3101	16.6095	14.3327	13.2814	15.2406	15.4226	17.9736	19.6195	21.3056 (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 Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.3980	43.8655	46.7327	43.4516	43.0674	39.9046	41.2347	43.0674	43.4516	46.7327	46.9987	50.3980 (61)
Total heat required for water heating calculated for each month	197.0628	172.1394	179.0999	158.8526	153.7973	135.4561	129.7773	144.6712	146.2690	166.5564	177.7957	192.4350 (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	197.0628	172.1394	179.0999	158.8526	153.7973	135.4561	129.7773	144.6712	146.2690	166.5564	177.7957	192.4350 (64)
Heat gains from water heating, kWh/month	61.3655	53.6175	55.6953	49.2337	47.5846	41.7470	39.7491	44.5501	45.0497	51.5246	55.2397	59.8268 (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	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8830	17.6599	14.3620	10.8730	8.1277	6.8617	7.4143	9.6374	12.9353	16.4244	19.1697	20.4356	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.0958	209.2448	203.8294	192.3006	177.7476	164.0698	154.9321	152.7831	158.1986	169.7274	184.2804	197.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	(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)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	(71)
Water heating gains (Table 5)	82.4806	79.7879	74.8592	68.3802	63.9577	57.9820	53.4262	59.8792	62.5690	69.2534	76.7218	80.4124	(72)
Total internal gains	370.6437	367.8769	354.2349	332.7380	311.0172	290.0977	276.9569	283.4840	294.8872	316.5894	341.3561	359.9905	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					3.8000	10.6334	0.6300	0.7000			0.7700	12.3489
East					6.4200	19.6403	0.6300	0.7000			0.7700	38.5349 (74)
Solar gains	50.8838	98.9818	164.2451	245.4693	308.6615	320.0352	302.9762	254.5619	192.5992	117.5395	63.2824	41.9839 (83)
Total gains	421.5274	466.8587	518.4801	578.2073	619.6787	610.1330	579.9331	538.0459	487.4863	434.1290	404.6385	401.9743 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.2580	77.4844	77.7076	78.7736	78.9762	79.9337	79.9337	80.1135	79.5622	78.9762	78.5673	78.1442	
alpha	6.1505	6.1656	6.1805	6.2516	6.2651	6.3289	6.3289	6.3409	6.3041	6.2651	6.2378	6.2096	
util living area	0.9984	0.9966	0.9898	0.9580	0.8537	0.6574	0.4869	0.5449	0.8234	0.9773	0.9965	0.9988	(86)
MIT	20.0802	20.1959	20.4040	20.6830	20.8956	20.9840	20.9979	20.9959	20.9388	20.6608	20.3231	20.0607	(87)
Th 2	20.1685	20.1707	20.1729	20.1832	20.1851	20.1941	20.1941	20.1958	20.1907	20.1851	20.1812	20.1771	(88)
util rest of house	0.9979	0.9955	0.9863	0.9435	0.8099	0.5828	0.3993	0.4526	0.7582	0.9668	0.9951	0.9984	(89)
MIT 2	18.9286	19.0991	19.4030	19.8067	20.0831	20.1835	20.1933	20.1940	20.1413	19.7831	19.2933	18.9068	(90)
Living area fraction									fLA = Living area / (4) =			0.4229	(91)
MIT	19.4157	19.5630	19.8264	20.1773	20.4267	20.5221	20.5336	20.5332	20.4786	20.1543	19.7289	19.3948	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4157	19.5630	19.8264	20.1773	20.4267	20.5221	20.5336	20.5332	20.4786	20.1543	19.7289	19.3948	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9944	0.9844	0.9434	0.8239	0.6139	0.4364	0.4918	0.7832	0.9663	0.9941	0.9979	(94)
Useful gains	420.3834	464.2676	510.4119	545.4850	510.5463	374.5713	253.1116	264.6028	381.7800	419.4857	402.2674	401.1499	(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	1009.3729	976.2846	884.7407	738.5721	570.0636	382.2186	253.8790	266.1622	413.6029	624.1223	829.2587	1003.1514	(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	438.2082	344.0754	278.5006	139.0227	44.2809	0.0000	0.0000	0.0000	0.0000	152.2496	307.4338	447.8891	(98)
Space heating												2151.6603	(98)
Space heating per m2											(98) / (4) =	28.9630	(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 Built)



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	2303.7048	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	438.2082 344.0754 278.5006 139.0227 44.2809 0.0000 0.0000 0.0000 0.0000 152.2496 307.4338 447.8891	(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)	469.1737 368.3891 298.1805 148.8466 47.4100 0.0000 0.0000 0.0000 0.0000 163.0081 329.1582 479.5387	(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		
Water heating requirement	197.0628 172.1394 179.0999 158.8526 153.7973 135.4561 129.7773 144.6712 146.2690 166.5564 177.7957 192.4350	(64)
Efficiency of water heater	87.0053 86.7610 86.1586 84.7175 82.3570 80.3000 80.3000 80.3000 80.3000 84.8260 86.4173 87.1074	(216)
Fuel for water heating, kWh/month	226.4951 198.4064 207.8725 187.5086 186.7447 168.6876 161.6155 180.1634 182.1532 196.3507 205.7409 220.9171	(219)
Water heating fuel used		2322.6556 (219)
Annual totals kWh/year		
Space heating fuel - main system		2303.7048 (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)		351.1398 (232)
Total delivered energy for all uses		5052.5003 (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	2303.7048	0.2160	497.6002 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2322.6556	0.2160	501.6936 (264)
Space and water heating			999.2939 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	351.1398	0.5190	182.2416 (268)
Total CO2, kg/m2/year			1220.4604 (272)
Emissions per m2 for space and water heating			13.4513 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4531 (272b)
Emissions per m2 for pumps and fans			0.5240 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4513 * 1.00) + 2.4531 + 0.5240, rounded to 2 d.p.			16.4300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1683 (8)
Measured/design AP50					Yes
Infiltration rate					3.1300
Number of sides sheltered					0.3248 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2517 (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												
	0.3209	0.3146	0.3083	0.2769	0.2706	0.2391	0.2391	0.2328	0.2517	0.2706	0.2831	0.2957 (22b)
Effective ac	0.5515	0.5495	0.5475	0.5383	0.5366	0.5286	0.5286	0.5271	0.5317	0.5366	0.5401	0.5437 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)
WT-E-03	20.1600	10.2200	9.9400	0.1600	1.5904		(29a)
WT-I-02	47.0400	2.1200	44.9200	0.1584	7.1162		(29a)
WT-I-11	3.8400		3.8400	0.2719	1.0441		(29a)
Total net area of external elements Aum (m ²)			71.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.5000		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			74.2900				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9508 (36)
Total fabric heat loss						(33) + (36) =	32.4508 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	32.4484	32.3307	32.2154	31.6738	31.5725	31.1007	31.1007	31.0134	31.2824	31.5725	31.7775	31.9918 (38)
Heat transfer coeff	64.8991	64.7815	64.6662	64.1246	64.0233	63.5515	63.5515	63.4642	63.7332	64.0233	64.2283	64.4426 (39)
Average = Sum(39)m / 12 =												64.1241 (39)
HLP	0.8736	0.8720	0.8705	0.8632	0.8618	0.8555	0.8555	0.8543	0.8579	0.8618	0.8646	0.8674 (40)
HLP (average)												0.8632 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)
Daily hot water use	98.8993	95.3029	91.7066	88.1103	84.5139	80.9176	80.9176	84.5139	88.1103	91.7066	95.3029	98.8993 (44)
Energy conte	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Energy content (annual)										Total = Sum(45)m =		1414.6099 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	31.1663	27.2582	28.1280	24.5227	23.5301	20.3047	18.8153	21.5908	21.8487	25.4625	27.7944	30.1829 (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	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8830	17.6599	14.3620	10.8730	8.1277	6.8617	7.4143	9.6374	12.9353	16.4244	19.1697	20.4356	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.0958	209.2448	203.8294	192.3006	177.7476	164.0698	154.9321	152.7831	158.1986	169.7274	184.2804	197.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	(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)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	(71)
Water heating gains (Table 5)	41.8901	40.5628	37.8065	34.0593	31.6265	28.2010	25.2894	29.0199	30.3454	34.2238	38.6033	40.5684	(72)
Total internal gains	327.0533	325.6518	314.1822	295.4172	275.6860	257.3167	245.8201	249.6248	259.6636	278.5598	300.2376	317.1465	(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
North													3.8000	10.6334	0.4500	0.0000	0.7700	14.0010
East													6.4200	19.6403	0.4500	0.0000	0.7700	43.6904
Solar gains	57.6913	112.2242	186.2190	278.3099	349.9563	362.8517	343.5105	288.6189	218.3664	133.2648	71.7488	47.6007	(83)					
Total gains	384.7446	437.8761	500.4012	573.7270	625.6423	620.1685	589.3306	538.2437	478.0300	411.8246	371.9864	364.7472	(84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	31.7972	31.8549	31.9117	32.1813	32.2322	32.4715	32.4715	32.5162	32.3789	32.2322	32.1293	32.0225		
alpha	3.1198	3.1237	3.1274	3.1454	3.1488	3.1648	3.1648	3.1677	3.1586	3.1488	3.1420	3.1348		
util living area	0.9741	0.9603	0.9293	0.8588	0.7399	0.5841	0.4498	0.5036	0.7270	0.9027	0.9617	0.9779	(86)	
MIT	19.1143	19.3435	19.7414	20.2438	20.6459	20.8808	20.9611	20.9441	20.7532	20.2143	19.5721	19.0647	(87)	
Th 2	20.1900	20.1914	20.1927	20.1989	20.2001	20.2055	20.2055	20.2065	20.2034	20.2001	20.1977	20.1953	(88)	
util rest of house	0.9706	0.9549	0.9194	0.8389	0.7037	0.5275	0.3766	0.4286	0.6764	0.8846	0.9555	0.9748	(89)	
MIT 2	18.4405	18.6679	19.0599	19.5494	19.9224	20.1275	20.1863	20.1773	20.0278	19.5313	18.9012	18.3952	(90)	
Living area fraction														
MIT	18.7255	18.9536	19.3482	19.8430	20.2284	20.4461	20.5140	20.5016	20.3346	19.8201	19.1850	18.6783	(92)	
Temperature adjustment														
adjusted MIT	18.7255	18.9536	19.3482	19.8430	20.2284	20.4461	20.5140	20.5016	20.3346	19.8201	19.1850	18.6783	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9623	0.9445	0.9071	0.8290	0.7051	0.5452	0.4057	0.4573	0.6854	0.8745	0.9458	0.9673	(94)
Useful gains	370.2323	413.5910	453.9067	475.6004	441.1149	338.1437	239.0968	246.1601	327.6209	360.1471	351.8201	352.8076	(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	936.1999	910.4143	830.8425	701.7184	546.0159	371.5291	248.7390	260.3049	397.3500	590.3038	776.1962	933.0216	(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	421.0799	333.8653	280.4402	162.8050	78.0463	0.0000	0.0000	0.0000	0.0000	171.2366	305.5508	431.6792	(98)
Space heating												2184.7034	(98)
Space heating per m2											(98) / (4) =	29.4078	(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	597.3844	470.2813	482.3277	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8616	0.9075	0.8846	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	514.6795	426.7875	426.6770	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	812.6796	774.9046	716.8265	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	214.5601	258.9991	215.8712	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												689.4304 (104)
Cooled Fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	53.6400	64.7498	53.9678	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												172.3576 (107)
Space cooling per m2												2.3201 (108)
Energy for space heating												29.4078 (99)
Energy for space cooling												2.3201 (108)
Total												31.7278 (109)
Dwelling Fabric Energy Efficiency (DFEE)												31.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				30.0000 / (5) =	0.1683 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4183 (18)
					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3242 (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	0.4133	0.4052	0.3971	0.3566	0.3485	0.3079	0.3079	0.2998	0.3242	0.3485	0.3647	0.3809 (22b)
	0.5854	0.5821	0.5788	0.5636	0.5607	0.5474	0.5474	0.5450	0.5525	0.5607	0.5665	0.5725 (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)			10.2200	1.3258	13.5492		(27)
WT-E-03	20.1600	10.2200	9.9400	0.1800	1.7892		(29a)
WT-I-02	47.0400	2.1200	44.9200	0.1800	8.0856		(29a)
WT-I-11	3.8400		3.8400	0.1800	0.6912		(29a)
Total net area of external elements Aum, m ²			71.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2352		(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)							6.0975 (36)
Total fabric heat loss						(33) + (36) =	32.3327 (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	34.4439	34.2488	34.0575	33.1591	32.9911	32.2086	32.2086	32.0637	32.5100	32.9911	33.3311	33.6866 (38)
Heat transfer coeff	66.7766	66.5815	66.3902	65.4919	65.3238	64.5413	64.5413	64.3965	64.8427	65.3238	65.6638	66.0193 (39)
Average = Sum(39)m / 12 =												65.4911 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8989	0.8962	0.8937	0.8816	0.8793	0.8688	0.8688	0.8668	0.8728	0.8793	0.8839	0.8887 (40)
HLP (average)												0.8816 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.8993	95.3029	91.7066	88.1103	84.5139	80.9176	80.9176	84.5139	88.1103	91.7066	95.3029	98.8993 (44)
Energy conte	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Energy content (annual)												Total = Sum(45)m = 1414.6099 (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 Built)

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	(59)
Heat gains from water heating, kWh/month	31.1663	27.2582	28.1280	24.5227	23.5301	20.3047	18.8153	21.5908	21.8487	25.4625	27.7944	30.1829 (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	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	117.2809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8830	17.6599	14.3620	10.8730	8.1277	6.8617	7.4143	9.6374	12.9353	16.4244	19.1697	20.4356	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.0958	209.2448	203.8294	192.3006	177.7476	164.0698	154.9321	152.7831	158.1986	169.7274	184.2804	197.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	34.7281	(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)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	(71)
Water heating gains (Table 5)	41.8901	40.5628	37.8065	34.0593	31.6265	28.2010	25.2894	29.0199	30.3454	34.2238	38.6033	40.5684	(72)
Total internal gains	327.0533	325.6518	314.1822	295.4172	275.6860	257.3167	245.8201	249.6248	259.6636	278.5598	300.2376	317.1465	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					3.8000	10.6334	0.6300	0.7000			0.7700	12.3489
East					6.4200	19.6403	0.6300	0.7000			0.7700	38.5349 (76)

Solar gains	50.8838	98.9818	164.2451	245.4693	308.6615	320.0352	302.9762	254.5619	192.5992	117.5395	63.2824	41.9839 (83)
Total gains	377.9370	424.6336	478.4273	540.8865	584.3475	577.3520	548.7963	504.1866	452.2627	396.0994	363.5200	359.1303 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.2580	77.4844	77.7076	78.7736	78.9762	79.9337	79.9337	80.1135	79.5622	78.9762	78.5673	78.1442	
alpha	6.1505	6.1656	6.1805	6.2516	6.2651	6.3289	6.3289	6.3409	6.3041	6.2651	6.2378	6.2096	
util living area	0.9991	0.9980	0.9933	0.9689	0.8785	0.6887	0.5136	0.5790	0.8584	0.9855	0.9981	0.9994	(86)
MIT	20.0229	20.1409	20.3536	20.6433	20.8748	20.9794	20.9972	20.9943	20.9212	20.6157	20.2694	20.0042	(87)
Th 2	20.1685	20.1707	20.1729	20.1832	20.1851	20.1941	20.1941	20.1958	20.1907	20.1851	20.1812	20.1771	(88)
util rest of house	0.9989	0.9973	0.9909	0.9575	0.8386	0.6130	0.4216	0.4823	0.7983	0.9784	0.9973	0.9992	(89)
MIT 2	19.2648	19.3844	19.5978	19.8893	20.0997	20.1846	20.1934	20.1941	20.1455	19.8678	19.5217	19.2533	(90)
Living area fraction									fLA = Living area / (4) =				
MIT	19.5854	19.7043	19.9174	20.2082	20.4275	20.5207	20.5333	20.5325	20.4736	20.1841	19.8379	19.5709	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5854	19.7043	19.9174	20.2082	20.4275	20.5207	20.5333	20.5325	20.4736	20.1841	19.8379	19.5709	(93)

8. Space heating requirement

Utilisation	0.9986	0.9968	0.9900	0.9579	0.8515	0.6446	0.4607	0.5234	0.8213	0.9784	0.9969	0.9990	(94)
Useful gains	377.4085	423.2866	473.6203	518.1008	497.5694	372.1647	252.8203	263.9142	371.4381	387.5265	362.3811	358.7634	(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	1020.7092	985.6946	890.7875	740.5956	570.1136	382.1329	253.8612	266.1197	413.2805	626.0722	836.4204	1014.7766	(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	478.6157	377.9382	310.3723	160.1962	53.9728	0.0000	0.0000	0.0000	0.0000	177.4780	341.3083	488.0738	(98)
Space heating												2387.9554	(98)
Space heating per m2												32.1437	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	606.6887	477.6060	489.4130	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9409	0.9749	0.9610	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.8165	465.6229	470.3228	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	762.6344	727.5269	677.0196	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	138.1089	194.8566	153.7824	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												486.7479	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	34.5272	48.7142	38.4456	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2													121.6870 (107)
Energy for space heating													1.6380 (108)
Energy for space cooling													32.1437 (99)
Total													1.6380 (108)
Target Fabric Energy Efficiency (TFEE)													33.7817 (109)
													38.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					3.1300
Infiltration rate					0.1565 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1213 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1274	0.1213	0.1213	0.1122	0.1122	0.1001	0.1031	0.0970	0.1001	0.1061	0.1061	0.1152 (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	
Opening Type 1			2.1200	1.0000	2.1200		(26)	
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)	
WT-E-03	20.1600	10.2200	9.9400	0.1600	1.5904		(29a)	
WT-I-02	47.0400	2.1200	44.9200	0.1584	7.1162		(29a)	
WT-I-11	3.8400		3.8400	0.2719	1.0441		(29a)	
Total net area of external elements Aum(A, m2)			71.0400				(31)	
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.5000	(33)	
Party Wall 1					22.5600	0.0000	(32)	
Party Floor 1					74.2900		(32d)	
Party Ceilings 1					74.2900		(32b)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								7.9508 (36)
Total fabric heat loss								(33) + (36) = 32.4508 (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	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188 (38)
Heat transfer coeff	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696 (39)
Average = Sum(39)m / 12 =												61.8696 (39)
HLP	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328 (40)
HLP (average)												0.8328 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.8993	95.3029	91.7066	88.1103	84.5139	80.9176	80.9176	84.5139	88.1103	91.7066	95.3029	98.8993 (44)
Energy conte	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Energy content (annual)												Total = Sum(45)m = 1414.6099 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.9997	19.2411	19.8551	17.3101	16.6095	14.3327	13.2814	15.2406	15.4226	17.9736	19.6195	21.3056 (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	14.1047	12.7187	14.0479	13.5568	13.9812	13.4984	13.9285	13.9626	13.5302	14.0203	13.6120	14.0937 (61)
Total heat required for water heating calculated for each month	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (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	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (64)
								Total per year (kWh/year) = Sum(64)m =				1579.6648 (64)
RHI water heating demand												1580 (64)
Heat gains from water heating, kWh/month	52.2922	45.8308	47.5241	41.7600	40.3130	35.1455	32.9225	37.2739	37.5693	43.3465	46.8930	50.7507 (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	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7075	44.1497	35.9050	27.1824	20.3191	17.1543	18.5358	24.0935	32.3383	41.0609	47.9241	51.0890	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	309.0983	312.3057	304.2230	287.0158	265.2949	244.8802	231.2420	228.0345	236.1173	253.3244	275.0454	295.4600	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	(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)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	(71)
Water heating gains (Table 5)	70.2852	68.2005	63.8764	58.0000	54.1841	48.8132	44.2507	50.0994	52.1796	58.2614	65.1291	68.2133	(72)
Total internal gains	530.4227	525.9877	505.3361	473.5300	441.1299	412.1794	395.3602	403.5592	421.9669	453.9784	489.4304	516.0941	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.8000	11.9814	0.4500	0.0000	0.7700		15.7760 (74)	
East					6.4200	22.3313	0.4500	0.0000	0.7700		49.6767 (76)	

Solar gains	65.4526	114.7835	188.3585	289.8972	354.6058	393.1292	368.2945	316.8837	239.3972	145.6257	83.4450	53.4477 (83)
Total gains	595.8753	640.7713	693.6947	763.4272	795.7357	805.3086	763.6547	720.4429	661.3641	599.6041	572.8754	569.5418 (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	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	
alpha	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	
util living area	0.9109	0.8879	0.8310	0.7214	0.5632	0.3731	0.2490	0.2717	0.5052	0.7515	0.8734	0.9197	(86)
MIT	19.8087	19.9628	20.2841	20.6325	20.8736	20.9760	20.9955	20.9939	20.9332	20.6461	20.1788	19.7574	(87)
Th 2	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	(88)
util rest of house	0.9004	0.8749	0.8117	0.6914	0.5197	0.3187	0.1877	0.2072	0.4473	0.7170	0.8566	0.9100	(89)
MIT 2	19.1463	19.2950	19.6026	19.9251	20.1346	20.2122	20.2235	20.2229	20.1842	19.9448	19.5073	19.0970	(90)
Living area fraction									fLA = Living area / (4) =				0.4229 (91)
MIT	19.4265	19.5775	19.8908	20.2243	20.4471	20.5352	20.5500	20.5490	20.5010	20.2414	19.7913	19.3763	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2765	19.4275	19.7408	20.0743	20.2971	20.3852	20.4000	20.3990	20.3510	20.0914	19.6413	19.2263	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8854	0.8598	0.7985	0.6852	0.5239	0.3301	0.2016	0.2218	0.4570	0.7106	0.8422	0.8952	(94)
Useful gains	527.5862	550.9076	553.8813	523.0711	416.8880	265.8642	153.9570	159.8059	302.2444	426.0631	482.4494	509.8756	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	877.0937	855.4996	763.5217	629.4791	451.4718	271.3134	154.6750	160.8009	318.6900	525.3588	720.2432	873.9886	(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	260.0336	204.6858	155.9725	76.6138	25.7303	0.0000	0.0000	0.0000	0.0000	73.8760	171.2115	270.9000	(98)
Space heating												1239.0236	(98)
RHI space heating demand												1239	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					3.1300
Infiltration rate					0.1565 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1213 (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	0.1546	0.1516	0.1486	0.1334	0.1304	0.1152	0.1152	0.1122	0.1213	0.1304	0.1364	0.1425 (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	
Opening Type 1			2.1200	1.0000	2.1200		(26)	
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)	
WT-E-03	20.1600	10.2200	9.9400	0.1600	1.5904		(29a)	
WT-I-02	47.0400	2.1200	44.9200	0.1584	7.1162		(29a)	
WT-I-11	3.8400		3.8400	0.2719	1.0441		(29a)	
Total net area of external elements Aum(A, m2)			71.0400				(31)	
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.5000	(33)	
Party Wall 1					22.5600	0.0000	(32)	
Party Floor 1					74.2900		(32d)	
Party Ceilings 1					74.2900		(32b)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								7.9508 (36)
Total fabric heat loss								(33) + (36) = 32.4508 (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	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188	29.4188 (38)
Heat transfer coeff	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696	61.8696 (39)
Average = Sum(39)m / 12 =												61.8696 (39)
HLP	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328	0.8328 (40)
HLP (average)												0.8328 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.8993	95.3029	91.7066	88.1103	84.5139	80.9176	80.9176	84.5139	88.1103	91.7066	95.3029	98.8993 (44)
Energy conte	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Energy content (annual)												Total = Sum(45)m = 1414.6099 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.9997	19.2411	19.8551	17.3101	16.6095	14.3327	13.2814	15.2406	15.4226	17.9736	19.6195	21.3056 (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	14.1047	12.7187	14.0479	13.5568	13.9812	13.4984	13.9285	13.9626	13.5302	14.0203	13.6120	14.0937 (61)
Total heat required for water heating calculated for each month	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (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	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (64)
Heat gains from water heating, kWh/month	52.2922	45.8308	47.5241	41.7600	40.3130	35.1455	32.9225	37.2739	37.5693	43.3465	46.8930	50.7507 (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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	49.7075	44.1497	35.9050	27.1824	20.3191	17.1543	18.5358	24.0935	32.3383	41.0609	47.9241	51.0890 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	309.0983	312.3057	304.2230	287.0158	265.2949	244.8802	231.2420	228.0345	236.1173	253.3244	275.0454	295.4600 (68)
Pumps, fans	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247 (71)
Total internal gains	70.2852	68.2005	63.8764	58.0000	54.1841	48.8132	44.2507	50.0994	52.1796	58.2614	65.1291	68.2133 (72)
	530.4227	525.9877	505.3361	473.5300	441.1299	412.1794	395.3602	403.5592	421.9669	453.9784	489.4304	516.0941 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.8000	10.6334	0.4500	0.0000	0.7700		14.0010 (74)	
East					6.4200	19.6403	0.4500	0.0000	0.7700		43.6904 (76)	
Solar gains	57.6913	112.2242	186.2190	278.3099	349.9563	362.8517	343.5105	288.6189	218.3664	133.2648	71.7488	47.6007 (83)
Total gains	588.1140	638.2119	691.5551	751.8399	791.0862	775.0311	738.8707	692.1781	640.3333	587.2432	561.1791	563.6948 (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	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	
alpha	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	
util living area	0.9228	0.8991	0.8515	0.7616	0.6312	0.4804	0.3590	0.3970	0.5933	0.7969	0.8949	0.9311 (86)	
MIT	19.6748	19.8590	20.1672	20.5244	20.7946	20.9362	20.9811	20.9736	20.8730	20.5259	20.0334	19.6098 (87)	
Th 2	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250 (88)	
util rest of house	0.9139	0.8876	0.8349	0.7357	0.5933	0.4296	0.2990	0.3347	0.5418	0.7685	0.8812	0.9230 (89)	
MIT 2	19.0151	19.1939	19.4906	19.8263	20.0681	20.1844	20.2159	20.2116	20.1385	19.8354	19.3671	18.9520 (90)	
Living area fraction	19.0151	19.1939	19.4906	19.8263	20.0681	20.1844	20.2159	20.2116	20.1385	19.8354	19.3671	18.9520 (91)	
MIT	19.2941	19.4752	19.7768	20.1216	20.3754	20.5024	20.5395	20.5339	20.4492	20.1274	19.6489	19.2302 (92)	
Temperature adjustment	19.1441	19.3252	19.6268	19.9716	20.2254	20.3524	20.3895	20.3839	20.2992	19.9774	19.4989	-0.1500	
adjusted MIT	19.1441	19.3252	19.6268	19.9716	20.2254	20.3524	20.3895	20.3839	20.2992	19.9774	19.4989	19.0802 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8992	0.8724	0.8205	0.7266	0.5934	0.4382	0.3119	0.3478	0.5470	0.7586	0.8663	0.9088 (94)
Ext temp.	528.8166	556.7659	567.4515	546.2589	469.3916	339.6288	230.4698	240.7186	350.2461	445.4808	486.1428	512.2614 (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	918.3984	892.4797	812.1477	684.9933	527.4608	355.8966	234.4574	246.4811	383.5409	580.1789	767.1131	920.6347 (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	289.8489	225.5997	182.0539	99.8888	43.2035	0.0000	0.0000	0.0000	0.0000	100.2154	202.2986	303.8297 (98)
Space heating per m2												1446.9385 (98)
												(98) / (4) = 19.4769 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1598.8271 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	289.8489	225.5997	182.0539	99.8888	43.2035	0.0000	0.0000	0.0000	0.0000	100.2154	202.2986	303.8297	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	320.2750	249.2814	201.1646	110.3743	47.7387	0.0000	0.0000	0.0000	0.0000	110.7353	223.5344	335.7234	(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													
Water heating requirement	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307	(64)
Efficiency of water heater (217)m	89.3317	89.2419	89.0451	88.6685	88.1015	87.3000	87.3000	87.3000	87.3000	88.6420	89.1391	87.3000	(216)
Fuel for water heating, kWh/month	179.9690	157.9893	164.4281	145.4381	141.5539	124.9140	117.3781	132.3786	133.2733	150.9939	162.0041	174.6667	(219)
Water heating fuel used												1784.9870	(219)
Annual totals kWh/year													
Space heating fuel - main system												1598.8271	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													40.0239 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													115.0239 (231)
Electricity for lighting (calculated in Appendix L)													351.1398 (232)
Total delivered energy for all uses													3849.9778 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1598.8271	3.4800	55.6392 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1784.9870	3.4800	62.1175 (247)
Mechanical ventilation fans	40.0239	13.1900	5.2792 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	351.1398	13.1900	46.3153 (250)
Additional standing charges			120.0000 (251)
Total energy cost			299.2437 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0536 (257)
SAP value		85.3025
SAP rating (Section 12)		85 (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	1598.8271	0.2160	345.3466 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1784.9870	0.2160	385.5572 (264)
Space and water heating			730.9038 (265)
Pumps and fans	115.0239	0.5190	59.6974 (267)
Energy for lighting	351.1398	0.5190	182.2416 (268)
Total kg/year			972.8428 (272)
CO2 emissions per m2			13.1000 (273)
EI value			89.0719
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8840 = 3.937$, stars = 4
Water heating environmental impact	$0.216 / 0.8840 = 0.2444$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.4000 (2b)	= 178.2960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.2960 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
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								3.1300				
Infiltration rate								0.1565	(18)			
Number of sides sheltered								3	(19)			
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750	(20)			
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1213	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Mechanical extract ventilation - decentralised	0.1274	0.1213	0.1213	0.1122	0.1122	0.1001	0.1031	0.0970	0.1001	0.1061	0.1061	0.1152 (22b)
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
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293		(27)
WT-E-03	20.1600	10.2200	9.9400	0.1600	1.5904		(29a)
WT-I-02	47.0400	2.1200	44.9200	0.1584	7.1162		(29a)
WT-I-11	3.8400		3.8400	0.2719	1.0441		(29a)
Total net area of external elements Aum(A, m2)			71.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.5000		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			74.2900				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9508 (36)
Total fabric heat loss							(33) + (36) = 32.4508 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3456 (42)
Average daily hot water use (litres/day)												89.9084 (43)
Daily hot water use	Jan 98.8993	Feb 95.3029	Mar 91.7066	Apr 88.1103	May 84.5139	Jun 80.9176	Jul 80.9176	Aug 84.5139	Sep 88.1103	Oct 91.7066	Nov 95.3029	Dec 98.8993 (44)
Energy conte	146.6648	128.2740	132.3672	115.4010	110.7300	95.5515	88.5426	101.6039	102.8173	119.8237	130.7969	142.0370 (45)
Energy content (annual)												Total = Sum(45)m = 1414.6099 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water storage loss:	21.9997	19.2411	19.8551	17.3101	16.6095	14.3327	13.2814	15.2406	15.4226	17.9736	19.6195	21.3056 (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	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	14.1047	12.7187	14.0479	13.5568	13.9812	13.4984	13.9285	13.9626	13.5302	14.0203	13.6120	14.0937 (61)
Total heat required for water heating calculated for each month	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (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	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307 (64)
Heat gains from water heating, kWh/month	52.2922	45.8308	47.5241	41.7600	40.3130	35.1455	32.9225	37.2739	37.5693	43.3465	46.8930	50.7507 (65)
Total per year (kWh/year) = Sum(63)m = 0.0000 (63)												

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	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371	140.7371 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7075	44.1497	35.9050	27.1824	20.3191	17.1543	18.5358	24.0935	32.3383	41.0609	47.9241	51.0890 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	309.0983	312.3057	304.2230	287.0158	265.2949	244.8802	231.2420	228.0345	236.1173	253.3244	275.0454	295.4600 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193	51.4193 (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)	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247	-93.8247 (71)
Water heating gains (Table 5)	70.2852	68.2005	63.8764	58.0000	54.1841	48.8132	44.2507	50.0994	52.1796	58.2614	65.1291	68.2133 (72)
Total internal gains	530.4227	525.9877	505.3361	473.5300	441.1299	412.1794	395.3602	403.5592	421.9669	453.9784	489.4304	516.0941 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					3.8000	11.9814	0.4500	0.0000	0.7700	15.7760 (74)		
East					6.4200	22.3313	0.4500	0.0000	0.7700	49.6767 (76)		

Solar gains	65.4526	114.7835	188.3585	289.8972	354.6058	393.1292	368.2945	316.8837	239.3972	145.6257	83.4450	53.4477 (83)
Total gains	595.8753	640.7713	693.6947	763.4272	795.7357	805.3086	763.6547	720.4429	661.3641	599.6041	572.8754	569.5418 (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	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542	33.3542
alpha	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236	3.2236
util living area	0.9109	0.8879	0.8310	0.7214	0.5632	0.3731	0.2490	0.2717	0.5052	0.7515	0.8734	0.9197 (86)
MIT	19.8087	19.9628	20.2841	20.6325	20.8736	20.9760	20.9955	20.9939	20.9332	20.6461	20.1788	19.7574 (87)
Th 2	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250	20.2250 (88)
util rest of house	0.9004	0.8749	0.8117	0.6914	0.5197	0.3187	0.1877	0.2072	0.4473	0.7170	0.8566	0.9100 (89)
MIT 2	19.1463	19.2950	19.6026	19.9251	20.1346	20.2122	20.2235	20.2229	20.1842	19.9448	19.5073	19.0970 (90)
Living area fraction	19.4265	19.5775	19.8908	20.2243	20.4471	20.5352	20.5500	20.5490	20.5010	20.2414	19.7913	0.4229 (91)
MIT	19.4265	19.5775	19.8908	20.2243	20.4471	20.5352	20.5500	20.5490	20.5010	20.2414	19.7913	19.3763 (92)
Temperature adjustment	19.2765	19.4275	19.7408	20.0743	20.2971	20.3852	20.4000	20.3990	20.3510	20.0914	19.6413	-0.1500
adjusted MIT	19.2765	19.4275	19.7408	20.0743	20.2971	20.3852	20.4000	20.3990	20.3510	20.0914	19.6413	19.2263 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8854	0.8598	0.7985	0.6852	0.5239	0.3301	0.2016	0.2218	0.4570	0.7106	0.8422	0.8952 (94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	877.0937	855.4996	763.5217	629.4791	451.4718	271.3134	154.6750	160.8009	318.6900	525.3588	720.2432	873.9886 (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	260.0336	204.6858	155.9725	76.6138	25.7303	0.0000	0.0000	0.0000	0.0000	73.8760	171.2115	270.9000 (98)
Space heating	1239.0236 (98)											
Space heating per m2	(98) / (4) = 16.6782 (99)											

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1369.0869 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	260.0336	204.6858	155.9725	76.6138	25.7303	0.0000	0.0000	0.0000	0.0000	73.8760	171.2115	270.9000	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	287.3299	226.1722	172.3453	84.6561	28.4313	0.0000	0.0000	0.0000	0.0000	81.6310	189.1840	299.3370	(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													
Water heating requirement	160.7695	140.9926	146.4151	128.9578	124.7111	109.0499	102.4711	115.5665	116.3476	133.8440	144.4089	156.1307	(64)
Efficiency of water heater (217)m	89.2501	89.1669	88.9218	88.4658	87.8312	87.3000	87.3000	87.3000	87.3000	88.4118	89.0072	87.3000	(216)
Fuel for water heating, kWh/month	180.1336	158.1222	164.6561	145.7714	141.9896	124.9140	117.3781	132.3786	133.2733	151.3870	162.2440	174.8322	(219)
Water heating fuel used												1787.0800	(219)
Annual totals kWh/year													
Space heating fuel - main system												1369.0869	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													40.0239 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													115.0239 (231)
Electricity for lighting (calculated in Appendix L)													351.1398 (232)
Total delivered energy for all uses													3622.3306 (238)

10a. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1369.0869	3.7400	51.2038 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1787.0800	3.7400	66.8368 (247)	
Mechanical ventilation fans	40.0239	19.1200	7.6526 (249)	
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)	
Energy for lighting	351.1398	19.1200	67.1379 (250)	
Additional standing charges			94.0000 (251)	
Total energy cost			301.1711 (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	1369.0869	0.2160	295.7228 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1787.0800	0.2160	386.0093 (264)	
Space and water heating			681.7320 (265)	
Pumps and fans	115.0239	0.5190	59.6974 (267)	
Energy for lighting	351.1398	0.5190	182.2416 (268)	
Total kg/year			923.6710 (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	1369.0869	1.2200	1670.2860 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1787.0800	1.2200	2180.2376 (264)	
Space and water heating			3850.5236 (265)	
Pumps and fans	115.0239	3.0700	353.1233 (267)	
Energy for lighting	351.1398	3.0700	1077.9993 (268)	
Primary energy kWh/year			5281.6462 (272)	
Primary energy kWh/m2/year			71.0950 (273)	

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 89

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	
Potential energy efficiency rating:		B 85	
Potential environmental impact rating:			B 89

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£89	£89	£0
Mains gas	£212	£212	£0
Space heating	£167	£167	£0
Water heating	£67	£67	£0
Lighting	£67	£67	£0
Total cost of fuels	£301	£301	£0
Total cost of uses	£301	£301	£0
Delivered energy	49 kWh/m²	49 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	71 kWh/m²	71 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	353.03 (P1)
Transmission heat loss coefficient	32.45 (37)
Summer heat loss coefficient	385.48 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	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	3.8000	81.1852	0.4500	0.0000	0.9000	124.9440
East	6.4200	117.5071	0.4500	0.0000	0.9000	305.5301
total:						430.4741

	Jun	Jul	Aug	
Solar gains	460	430	370	(P4)
Internal gains	409	392	401	
Total summer gains	869	823	771	(P5)
Summer gain/loss ratio	2.25	2.13	2.00	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.55	21.33	21.10	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			