

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW027c_127_As_Built				Issued on Date	22/11/2021
Assessment Reference	001	Prop Type Ref	MFF			
Property						
SAP Rating	85 B	DER	15.38	TER	17.24	
Environmental	88 B	% DER<TER	10.81			
CO ₂ Emissions (t/year)	0.98	DFEE	35.39	TFEE	42.99	
General Requirements Compliance	Pass	% DFEE<TFEE	17.67			
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) 17.24 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.38 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 43.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 35.4 kWh/m²/yr OK

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	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
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: 3.54 (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 3.5 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) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					3.5400
Number of sides sheltered					0.1770 (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) =	0.1372 (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	0.1749	0.1715	0.1680	0.1509	0.1475	0.1303	0.1303	0.1269	0.1372	0.1475	0.1543	0.1612 (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)
Flat Roof	20.2000		20.2000	0.1500	3.0300		(30)
Total net area of external elements Aum(A, m ²)			91.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.5300		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			54.0900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
9.8128 (36)
(33) + (36) = 37.3428 (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	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616 (39)
Average = Sum(39)m / 12 =												66.7616 (39)
HLP	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987 (40)
HLP (average)												0.8987 (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)

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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)
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)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1579.6648 (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	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)

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	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)

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	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101
alpha	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607
util living area	0.9687	0.9540	0.9218	0.8520	0.7355	0.5852	0.4526	0.5036	0.7198	0.8930	0.9548	0.9730 (86)
MIT	19.1249	19.3459	19.7356	20.2202	20.6261	20.8669	20.9550	20.9369	20.7400	20.2034	19.5653	19.0588 (87)
Th 2	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686 (88)
util rest of house	0.9644	0.9477	0.9109	0.8311	0.6982	0.5266	0.3762	0.4255	0.6673	0.8732	0.9476	0.9692 (89)
MIT 2	18.4351	18.6530	19.0353	19.5019	19.8770	20.0823	20.1467	20.1362	19.9854	19.4953	18.8725	18.3698 (90)
Living area fraction	18.7268	18.9461	19.3315	19.8057	20.1938	20.4141	20.4886	20.4748	20.3045	19.7948	19.1655	18.6612 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5768	18.7961	19.1815	19.6557	20.0438	20.2641	20.3386	20.3248	20.1545	19.6448	19.0155	18.5112 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9538	0.9348	0.8954	0.8164	0.6921	0.5336	0.3923	0.4408	0.6664	0.8584	0.9348	0.9595 (94)
Ext temp.	396.9207	437.9501	474.0851	490.3876	450.7079	343.5404	239.8167	247.8745	335.0919	376.7041	375.3535	379.3775 (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	953.1458	927.7260	846.6344	718.0660	557.0459	378.1445	249.5953	262.0285	404.2095	603.8440	795.5006	955.4399 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m ²	413.8315	329.1294	277.1767	163.9285	79.1154	0.0000	0.0000	0.0000	0.0000	168.9921	302.5059	428.5905 (98)
(98) / (4) = 29.1193 (99)												

8c. Space cooling requirement

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Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2390.3536 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	413.8315	329.1294	277.1767	163.9285	79.1154	0.0000	0.0000	0.0000	0.0000	168.9921	302.5059	428.5905 (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)	457.2724	363.6789	306.2726	181.1365	87.4204	0.0000	0.0000	0.0000	0.0000	186.7316	334.2607	473.5806 (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	89.5813	89.5159	89.3677	89.0626	88.5148	87.3000	87.3000	87.3000	87.3000	89.0572	89.4406	89.6228 (217)	
Fuel for water heating, kWh/month	179.4677	157.5056	163.8345	144.7946	140.8929	124.9140	117.3781	132.3786	133.2733	150.2899	161.4578	174.2087 (219)	
Water heating fuel used												1780.3956 (219)	
Annual totals kWh/year													
Space heating fuel - main system												2390.3536 (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												4636.9129 (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	2390.3536	0.2160	516.3164 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1780.3956	0.2160	384.5654 (264)
Space and water heating			900.8818 (265)
Pumps and fans	115.0239	0.5190	59.6974 (267)
Energy for lighting	351.1398	0.5190	182.2416 (268)
Total CO2, kg/year			1142.8208 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3800 (273)

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

DER		15.3800 ZC1
Total Floor Area	TFA	74.2900
Assumed number of occupants	N	2.3456
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.5191 ZC2
CO2 emissions from cooking, equation (L16)		2.3596 ZC3
Total CO2 emissions		34.2587 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.2587 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 * 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) =				30.0000 / (5) =	0.1683 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4183	(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) =		0.3242 (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)
Effective ac	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 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)			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)					
Flat Roof	20.2000		20.2000	0.1300	2.6260			(30)					
Total net area of external elements Aum(A, m2)			91.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	28.8612			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								7.9595 (36)					
Total fabric heat loss						(33) + (36) =		36.8207 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.4439	Feb 34.2488	Mar 34.0575	Apr 33.1591	May 32.9911	Jun 32.2086	Jul 32.2086	Aug 32.0637	Sep 32.5100	Oct 32.9911	Nov 33.3311	Dec 33.6866	(38)
Heat transfer coeff	71.2646	71.0695	70.8782	69.9799	69.8118	69.0293	69.0293	68.8845	69.3307	69.8118	70.1518	70.5073	(39)
Average = Sum(39)m / 12 =													(39)
HLP	Jan 0.9593	Feb 0.9566	Mar 0.9541	Apr 0.9420	May 0.9397	Jun 0.9292	Jul 0.9292	Aug 0.9272	Sep 0.9332	Oct 0.9397	Nov 0.9443	Dec 0.9491	(40)
HLP (average)												0.9420	(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												
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												

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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 (57)
Total heat required for water heating calculated for each month	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)
Solar input	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)
Output from w/h	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)
Heat gains from water heating, kWh/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 (64)
	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 (74)		
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	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	72.3925	72.5913	72.7872	73.7216	73.8991	74.7367	74.7367	74.8939	74.4118	73.8991	73.5409	73.1701	
alpha	5.8262	5.8394	5.8525	5.9148	5.9266	5.9824	5.9824	5.9929	5.9608	5.9266	5.9027	5.8780	
util living area	0.9985	0.9968	0.9909	0.9642	0.8748	0.6917	0.5185	0.5785	0.8481	0.9804	0.9967	0.9988	(86)
MIT	19.9925	20.1105	20.3262	20.6200	20.8591	20.9740	20.9960	20.9926	20.9146	20.6051	20.2490	19.9725	(87)
Th 2	20.1174	20.1196	20.1218	20.1320	20.1339	20.1428	20.1428	20.1444	20.1393	20.1339	20.1300	20.1260	(88)
util rest of house	0.9980	0.9958	0.9877	0.9511	0.8329	0.6122	0.4203	0.4763	0.7840	0.9709	0.9954	0.9985	(89)
MIT 2	18.7621	18.9359	19.2512	19.6777	19.9939	20.1252	20.1412	20.1412	20.0689	19.6639	19.1465	18.7392	(90)
Living area fraction	19.2825	19.4327	19.7058	20.0762	20.3599	20.4842	20.5027	20.5013	20.4266	20.0620	19.6128	19.2608	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2825	19.4327	19.7058	20.0762	20.3599	20.4842	20.5027	20.5013	20.4266	20.0620	19.6128	19.2608	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	420.3902	464.3688	511.0610	549.3846	523.5365	393.5400	267.9258	279.6607	393.6271	421.0473	402.3712	401.1458	(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	1067.7222	1032.8326	936.0072	782.1096	604.5607	406.1821	269.4021	282.5171	438.6249	660.5560	877.7945	1061.8998	(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	481.6151	382.0077	316.1600	167.5620	60.2820	0.0000	0.0000	0.0000	0.0000	178.1945	342.3048	491.6010	(98)
Space heating												2419.7270	(98)
Space heating per m2												32.5714	(99)

8c. Space cooling requirement

Not applicable

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

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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													2590.7142 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	481.6151	382.0077	316.1600	167.5620	60.2820	0.0000	0.0000	0.0000	0.0000	178.1945	342.3048	491.6010	(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)	515.6478	409.0018	338.5011	179.4026	64.5417	0.0000	0.0000	0.0000	0.0000	190.7864	366.4934	526.3394	(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	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	87.2148	87.0007	86.4670	85.1857	82.9083	80.3000	80.3000	80.3000	80.3000	85.2214	86.6733	87.3106	(216)
Fuel for water heating, kWh/month	225.9511	197.8597	207.1308	186.4780	185.5029	168.6876	161.6155	180.1634	182.1532	195.4396	205.1331	220.4029	(219)
Water heating fuel used												2316.5178	(219)
Annual totals kWh/year													
Space heating fuel - main system												2590.7142	(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												5333.3718	(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	2590.7142	0.2160	559.5943 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2316.5178	0.2160	500.3679 (264)
Space and water heating			1059.9621 (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			1281.1287 (272)
Emissions per m2 for space and water heating			14.2679 (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) = (14.2679 * 1.00) + 2.4531 + 0.5240, rounded to 2 d.p.			17.2400 (273)

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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	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) =				30.0000 / (5) =	0.1683 (8)
Pressure test				Yes	
Measured/design AP50				3.5400	
Infiltration rate				0.3453	(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) =		0.2676 (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	0.3412	0.3345	0.3278	0.2943	0.2876	0.2542	0.2542	0.2475	0.2676	0.2876	0.3010	0.3144 (22b)
	0.5582	0.5559	0.5537	0.5433	0.5414	0.5323	0.5323	0.5306	0.5358	0.5414	0.5453	0.5494 (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)
Flat Roof	20.2000		20.2000	0.1500	3.0300		(30)
Total net area of external elements Aum(A, m ²)			91.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.5300		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			54.0900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
9.8128 (36)
(33) + (36) = 37.3428 (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	32.8429	32.7099	32.5796	31.9675	31.8529	31.3198	31.3198	31.2210	31.5251	31.8529	32.0846	32.3269 (38)
Heat transfer coeff	70.1857	70.0527	69.9224	69.3103	69.1957	68.6626	68.6626	68.5638	68.8679	69.1957	69.4274	69.6696 (39)
Average = Sum(39)m / 12 =												69.3097 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9448	0.9430	0.9412	0.9330	0.9314	0.9243	0.9243	0.9229	0.9270	0.9314	0.9345	0.9378 (40)
HLP (average)												0.9330 (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:												

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	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	0.4500	0.0000	0.7700	14.0010
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	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, 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	29.4022	29.4580	29.5129	29.7735	29.8228	30.0544	30.0544	30.0977	29.9648	29.8228	29.7233	29.6199	
alpha	2.9601	2.9639	2.9675	2.9849	2.9882	3.0036	3.0036	3.0065	2.9977	2.9882	2.9816	2.9747	
util living area	0.9749	0.9621	0.9337	0.8695	0.7597	0.6105	0.4766	0.5308	0.7476	0.9095	0.9634	0.9783	(86)
MIT	18.9365	19.1694	19.5828	20.1165	20.5623	20.8413	20.9446	20.9226	20.6930	20.1022	19.4233	18.8881	(87)
Th 2	20.1296	20.1311	20.1326	20.1396	20.1409	20.1469	20.1469	20.1481	20.1446	20.1409	20.1382	20.1355	(88)
util rest of house	0.9712	0.9566	0.9239	0.8499	0.7229	0.5503	0.3957	0.4489	0.6959	0.8917	0.9572	0.9752	(89)
MIT 2	18.2207	18.4521	18.8600	19.3818	19.7980	20.0436	20.1199	20.1080	19.9266	19.3786	18.7111	18.1770	(90)
Living area fraction									fLA = Living area / (4) =			0.4229	(91)
MIT	18.5234	18.7555	19.1657	19.6925	20.1213	20.3810	20.4687	20.4525	20.2507	19.6846	19.0123	18.4778	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5234	18.7555	19.1657	19.6925	20.1213	20.3810	20.4687	20.4525	20.2507	19.6846	19.0123	18.4778	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9626	0.9458	0.9108	0.8382	0.7220	0.5676	0.4272	0.4794	0.7029	0.8804	0.9470	0.9674	(94)
Ext temp.	370.3536	414.1546	455.7682	480.9219	451.7382	352.0072	251.7400	258.0427	335.9938	362.5719	352.2672	352.8444	(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	998.2816	970.6158	885.6176	748.0298	582.7164	396.9382	265.6342	277.8565	423.5891	628.6165	827.0405	994.7258	(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	467.1784	373.9419	319.8080	192.3176	97.4478	0.0000	0.0000	0.0000	0.0000	197.9372	341.8368	477.5597	(98)
												2468.0274	(98)
												33.2215	(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	645.4281	508.1030	521.0851	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8290	0.8812	0.8549	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	535.0778	447.7153	445.4680	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	199.8733	243.4289	201.8907	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			645.1929 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	49.9683	60.8572	50.4727	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												161.2982 (107)
Energy for space heating												2.1712 (108)
Energy for space cooling												33.2215 (99)
Total												2.1712 (108)
Dwelling Fabric Energy Efficiency (DFEE)												35.3927 (109)
												35.4 (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	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					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 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)			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)					
Flat Roof	20.2000		20.2000	0.1300	2.6260			(30)					
Total net area of external elements Aum(A, m2)			91.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) =	28.8612		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								7.9595 (36)					
Total fabric heat loss						(33) + (36) =		36.8207 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.4439	Feb 34.2488	Mar 34.0575	Apr 33.1591	May 32.9911	Jun 32.2086	Jul 32.2086	Aug 32.0637	Sep 32.5100	Oct 32.9911	Nov 33.3311	Dec 33.6866	(38)
Heat transfer coeff	71.2646	71.0695	70.8782	69.9799	69.8118	69.0293	69.0293	68.8845	69.3307	69.8118	70.1518	70.5073	(39)
Average = Sum(39)m / 12 =													(39)
HLP	Jan 0.9593	Feb 0.9566	Mar 0.9541	Apr 0.9420	May 0.9397	Jun 0.9292	Jul 0.9292	Aug 0.9272	Sep 0.9332	Oct 0.9397	Nov 0.9443	Dec 0.9491	(40)
HLP (average)												0.9420	(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	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 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	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			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 (74)
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)												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	72.3925	72.5913	72.7872	73.7216	73.8991	74.7367	74.7367	74.8939	74.4118	73.8991	73.5409	73.1701
alpha	5.8262	5.8394	5.8525	5.9148	5.9266	5.9824	5.9824	5.9929	5.9608	5.9266	5.9027	5.8780
util living area	0.9991	0.9981	0.9939	0.9733	0.8966	0.7223	0.5462	0.6135	0.8792	0.9873	0.9981	0.9994 (86)
MIT	19.9359	20.0560	20.2760	20.5791	20.8353	20.9674	20.9947	20.9900	20.8937	20.5597	20.1959	19.9166 (87)
Th 2	20.1174	20.1196	20.1218	20.1320	20.1339	20.1428	20.1428	20.1444	20.1393	20.1339	20.1300	20.1260 (88)
util rest of house	0.9989	0.9974	0.9916	0.9630	0.8588	0.6425	0.4437	0.5070	0.8213	0.9808	0.9974	0.9992 (89)
MIT 2	19.1355	19.2573	19.4780	19.7836	20.0196	20.1274	20.1413	20.1414	20.0771	19.7696	19.4057	19.1234 (90)
Living area fraction	19.4740	19.5951	19.8155	20.1201	20.3646	20.4827	20.5023	20.5003	20.4225	20.1038	19.7399	19.4589 (92)
MIT	19.4740	19.5951	19.8155	20.1201	20.3646	20.4827	20.5023	20.5003	20.4225	20.1038	19.7399	19.4589 (93)
Temperature adjustment												0.0000
adjusted MIT	19.4740	19.5951	19.8155	20.1201	20.3646	20.4827	20.5023	20.5003	20.4225	20.1038	19.7399	19.4589 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9986	0.9969	0.9907	0.9629	0.8700	0.6755	0.4873	0.5524	0.8426	0.9805	0.9969	0.9989 (94)
Ext temp.	377.3987	423.3153	473.9598	520.7959	508.3722	390.0277	267.4154	278.5242	381.0835	388.3763	362.4071	358.7517 (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	1081.3713	1044.3733	943.7816	785.1780	604.8896	406.0767	269.3710	282.4476	438.3445	663.4747	886.7098	1075.8616 (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	523.7556	417.3510	349.5475	190.3552	71.8090	0.0000	0.0000	0.0000	0.0000	204.6732	377.4979	533.5297 (98)
Space heating per m2												2668.5190 (98)
												35.9203 (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	648.8759	510.8172	523.5218	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9161	0.9608	0.9418	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	594.4262	490.7771	493.0523	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	121.1099	176.1419	136.8716	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												434.1234 (104)
Cooled fraction												1.0000 (105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	30.2775	44.0355	34.2179	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											108.5308 (107)
Space cooling per m2											1.4609 (108)
Energy for space heating											35.9203 (99)
Energy for space cooling											1.4609 (108)
Total											37.3812 (109)
Target Fabric Energy Efficiency (TFEE)											43.0 (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					3.5400
Infiltration rate					0.1770 (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) =				0.1372 (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	0.1440	0.1372	0.1372	0.1269	0.1269	0.1132	0.1166	0.1097	0.1132	0.1200	0.1200	0.1303 (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)
Flat Roof	20.2000		20.2000	0.1500	3.0300		(30)
Total net area of external elements Aum(A, m ²)			91.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.5300		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			54.0900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
9.8128 (36)
(33) + (36) = 37.3428 (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	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616 (39)
Average = Sum(39)m / 12 =												66.7616 (39)
HLP	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987 (40)
HLP (average)												0.8987 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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)
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)
RHI water heating demand	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)
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	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101
alpha	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607
util living area	0.9171	0.8961	0.8443	0.7424	0.5900	0.3977	0.2674	0.2914	0.5323	0.7706	0.8830	0.9251 (86)
MIT	19.6433	19.8043	20.1510	20.5409	20.8297	20.9642	20.9927	20.9903	20.9073	20.5641	20.0463	19.5916 (87)
Th 2	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686 (88)
util rest of house	0.9068	0.8835	0.8252	0.7118	0.5435	0.3367	0.1972	0.2178	0.4694	0.7357	0.8665	0.9156 (89)
MIT 2	18.9420	19.0978	19.4310	19.7942	20.0472	20.1498	20.1664	20.1655	20.1125	19.8238	19.3361	18.8922 (90)
Living area fraction									fLA = Living area / (4) =			0.4229 (91)
MIT	19.2386	19.3966	19.7355	20.1100	20.3782	20.4943	20.5158	20.5144	20.4487	20.1369	19.6365	19.1880 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0886	19.2466	19.5855	19.9600	20.2282	20.3443	20.3658	20.3644	20.2987	19.9869	19.4865	19.0380 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8909	0.8671	0.8101	0.7035	0.5470	0.3499	0.2140	0.2354	0.4796	0.7274	0.8507	0.9000 (94)
Useful gains	530.8760	555.6406	561.9967	537.1035	435.2680	281.7514	163.4423	169.5905	317.1983	436.1255	487.3511	512.6119 (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	933.9017	911.0677	813.5220	671.6237	482.5652	290.0304	164.6233	171.2004	340.3956	559.9219	766.8566	930.5244 (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	299.8512	238.8470	187.1348	96.8545	35.1891	0.0000	0.0000	0.0000	0.0000	92.1045	201.2440	310.9269 (98)
Space heating												1462.1521 (98)
RHI space heating demand												1462 (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					3.5400
Infiltration rate					0.1770 (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) =				0.1372 (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	0.1749	0.1715	0.1680	0.1509	0.1475	0.1303	0.1303	0.1269	0.1372	0.1475	0.1543	0.1612 (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)
Flat Roof	20.2000		20.2000	0.1500	3.0300		(30)
Total net area of external elements Aum(A, m ²)			91.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.5300		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			54.0900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

100.0000 (35)
9.8128 (36)
(33) + (36) = 37.3428 (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	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616 (39)
Average = Sum(39)m / 12 =												66.7616 (39)
HLP	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987 (40)
HLP (average)												0.8987 (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)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
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)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1579.6648 (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	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	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, 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	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	
alpha	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	
util living area	0.9279	0.9063	0.8630	0.7801	0.6564	0.5074	0.3830	0.4224	0.6195	0.8128	0.9026	0.9355	(86)
MIT	19.5006	19.6923	20.0221	20.4170	20.7322	20.9104	20.9716	20.9612	20.8315	20.4284	19.8897	19.4345	(87)
Th 2	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	(88)
util rest of house	0.9192	0.8951	0.8466	0.7540	0.6167	0.4519	0.3155	0.3529	0.5649	0.7845	0.8891	0.9275	(89)
MIT 2	18.8019	18.9883	19.3071	19.6801	19.9644	20.1120	20.1552	20.1493	20.0542	19.6994	19.1846	18.7376	(90)
Living area fraction	19.0974	19.2860	19.6095	19.9918	20.2892	20.4497	20.5005	20.4926	20.3830	20.0077	19.4828	19.0323	(92)
MIT	18.9474	19.1360	19.4595	19.8418	20.1392	20.2997	20.3505	20.3426	20.2330	19.8577	19.3328	18.8823	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	531.4875	560.9031	574.5024	558.4474	486.6942	357.2692	244.2808	254.5879	364.5827	453.7391	489.9836	514.4353	(94)
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	977.8824	950.4210	865.1962	730.4912	563.4131	380.5185	250.3891	263.2172	409.4467	618.0594	816.6833	980.2175	(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	332.1178	261.7560	216.2762	123.8715	57.0789	0.0000	0.0000	0.0000	0.0000	122.2543	235.2238	346.5420	(98)
Space heating												1695.1205	(98)
Space heating per m ²												22.8176	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1873.0614 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	332.1178	261.7560	216.2762	123.8715	57.0789	0.0000	0.0000	0.0000	0.0000	122.2543	235.2238	346.5420	(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)	366.9810	289.2332	238.9792	136.8746	63.0706	0.0000	0.0000	0.0000	0.0000	135.0877	259.9158	382.9193	(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	89.4308	89.3534	89.1804	88.8390	88.2801	87.3000	87.3000	87.3000	87.3000	88.7989	89.2555	89.4812	(216)
Fuel for water heating, kWh/month	179.7698	157.7921	164.1787	145.1589	141.2675	124.9140	117.3781	132.3786	133.2733	150.7271	161.7928	174.4843	(219)
Water heating fuel used												1783.1151	(219)
Annual totals kWh/year													
Space heating fuel - main system												1873.0614	(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													4122.3402 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1873.0614	3.4800	65.1825 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1783.1151	3.4800	62.0524 (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			308.7219 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.0870 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	84.8369
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	1873.0614	0.2160	404.5813 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1783.1151	0.2160	385.1529 (264)
Space and water heating			789.7341 (265)
Pumps and fans	115.0239	0.5190	59.6974 (267)
Energy for lighting	351.1398	0.5190	182.2416 (268)
Total kg/year			1031.6731 (272)
CO2 emissions per m2			13.8900 (273)
EI value			88.4111
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	$3.48 / 0.8848 = 3.933$, stars = 4
Water heating environmental impact	$0.216 / 0.8848 = 0.2441$, 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 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					3.5400
Infiltration rate					0.1770 (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) =				0.1372 (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	0.1440	0.1372	0.1372	0.1269	0.1269	0.1132	0.1166	0.1097	0.1132	0.1200	0.1200	0.1303 (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)
Flat Roof	20.2000		20.2000	0.1500	3.0300		(30)
Total net area of external elements Aum(A, m ²)			91.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.5300		(33)
Party Wall 1			22.5600	0.0000	0.0000		(32)
Party Floor 1			74.2900				(32d)
Party Ceilings 1			54.0900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.8128 (36)
Total fabric heat loss (33) + (36) = 37.3428 (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	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616	66.7616 (39)
Average = Sum(39)m / 12 =												66.7616 (39)
HLP	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987	0.8987 (40)
HLP (average)												0.8987 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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)
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)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												1579.6648 (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	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, 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	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	30.9101	
alpha	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	3.0607	
util living area	0.9171	0.8961	0.8443	0.7424	0.5900	0.3977	0.2674	0.2914	0.5323	0.7706	0.8830	0.9251	(86)
MIT	19.6433	19.8043	20.1510	20.5409	20.8297	20.9642	20.9927	20.9903	20.9073	20.5641	20.0463	19.5916	(87)
Th 2	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	20.1686	(88)
util rest of house	0.9068	0.8835	0.8252	0.7118	0.5435	0.3367	0.1972	0.2178	0.4694	0.7357	0.8665	0.9156	(89)
MIT 2	18.9420	19.0978	19.4310	19.7942	20.0472	20.1498	20.1664	20.1655	20.1125	19.8238	19.3361	18.8922	(90)
Living area fraction	19.2386	19.3966	19.7355	20.1100	20.3782	20.4943	20.5158	20.5144	20.4487	20.1369	19.6365	19.1880	(91)
MIT	19.2386	19.3966	19.7355	20.1100	20.3782	20.4943	20.5158	20.5144	20.4487	20.1369	19.6365	19.1880	(92)
Temperature adjustment	19.0886	19.2466	19.5855	19.9600	20.2282	20.3443	20.3658	20.3644	20.2987	19.9869	19.4865	19.0380	(93)
adjusted MIT	19.0886	19.2466	19.5855	19.9600	20.2282	20.3443	20.3658	20.3644	20.2987	19.9869	19.4865	19.0380	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8909	0.8671	0.8101	0.7035	0.5470	0.3499	0.2140	0.2354	0.4796	0.7274	0.8507	0.9000	(94)
Ext temp.	530.8760	555.6406	561.9967	537.1035	435.2680	281.7514	163.4423	169.5905	317.1983	436.1255	487.3511	512.6119	(95)
Heat loss rate W	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)
Month fracti	933.9017	911.0677	813.5220	671.6237	482.5652	290.0304	164.6233	171.2004	340.3956	559.9219	766.8566	930.5244	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	299.8512	238.8470	187.1348	96.8545	35.1891	0.0000	0.0000	0.0000	0.0000	92.1045	201.2440	310.9269	(98)
Space heating												1462.1521	(98)
Space heating per m ²												19.6817	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1615.6376	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	299.8512	238.8470	187.1348	96.8545	35.1891	0.0000	0.0000	0.0000	0.0000	92.1045	201.2440	310.9269	(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)	331.3272	263.9194	206.7788	107.0216	38.8830	0.0000	0.0000	0.0000	0.0000	101.7730	222.3690	343.5657	(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	89.3568	89.2852	89.0669	88.6444	87.9846	87.3000	87.3000	87.3000	87.3000	88.5767	89.1350	89.4045	(216)	
Fuel for water heating, kWh/month	179.9186	157.9127	164.3878	145.4777	141.7419	124.9140	117.3781	132.3786	133.2733	151.1052	162.0115	174.6341	(219)	
Water heating fuel used												1785.1333	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1615.6376	(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													3866.9347	(238)

10a. Fuel costs - using BEDF prices (485)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1615.6376	3.7400	60.4248 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1785.1333	3.7400	66.7640 (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			310.3193 (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	1615.6376	0.2160	348.9777 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1785.1333	0.2160	385.5888 (264)
Space and water heating			734.5665 (265)
Pumps and fans	115.0239	0.5190	59.6974 (267)
Energy for lighting	351.1398	0.5190	182.2416 (268)
Total kg/year			976.5055 (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	1615.6376	1.2200	1971.0779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1785.1333	1.2200	2177.8626 (264)
Space and water heating			4148.9406 (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			5580.0632 (272)
Primary energy kWh/m2/year			75.1119 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 88

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 88

Fuel prices for cost data on this page from database revision number 485 TEST (29 Oct 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	£221	£221	£0
Space heating	£176	£176	£0
Water heating	£67	£67	£0
Lighting	£67	£67	£0
Total cost of fuels	£310	£310	£0
Total cost of uses	£310	£310	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	75 kWh/m²	75 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 37.34 (37)
 Summer heat loss coefficient 390.37 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
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
North	3.8000	81.1852	0.4500
East	6.4200	117.5071	0.4500
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	2.23	2.11	1.97	(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	19.53	21.31	21.07	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			