

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025g_122_As_Built			Issued on Date	01/03/2022
Assessment Reference	001	Prop Type Ref	TFF		
Property					
SAP Rating	84 B	DER	17.77	TER	18.76
Environmental	88 B	% DER<TER	5.28		
CO ₂ Emissions (t/year)	0.86	DFEE	41.95	TFEE	45.32
General Requirements Compliance	Pass	% DFEE<TFEE	7.44		
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

Top-floor flat, total floor area 59 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) 18.76 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.29 (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	1.24 (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: 4.15 (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): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.86 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

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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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (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					4.1500
Infiltration rate					0.2075 (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) =				0.1608 (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	0.2050	0.2010	0.1970	0.1769	0.1729	0.1528	0.1528	0.1488	0.1608	0.1729	0.1809	0.1890 (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)			7.8600	1.2357	9.7129		(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861		(29a)
Flat Roof	58.6200		58.6200	0.1500	8.7930		(30)
Total net area of external elements Aum(A, m2)			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.8500		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Floor 1			58.6200				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3437 (36)
Total fabric heat loss							(33) + (36) = 41.1937 (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	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135 (38)
Average = Sum(39)m / 12 =	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9424 (42)
Average daily hot water use (litres/day)												80.3310 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy content (annual)	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1263.9198 (45)
	19.6562	17.1915	17.7400	15.4662	14.8402	12.8060	11.8666	13.6171	13.7797	16.0589	17.5296	19.0360 (46)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0345	12.6595	13.9891	13.5076	13.9359	13.4609	13.8938	13.9211	13.4864	13.9671	13.5516	14.0257	(61)
Total heat required for water heating calculated for each month	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(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	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(64)
Heat gains from water heating, kWh/month	47.0799	41.2726	42.8210	37.6603	36.3797	31.7518	29.7777	33.6648	33.9166	39.0891	42.2452	45.7029	(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	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3610	14.5317	11.8179	8.9469	6.6879	5.6462	6.1010	7.9303	10.6440	13.5150	15.7740	16.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.4536	171.2120	166.7809	157.3476	145.4397	134.2480	126.7713	125.0129	129.4440	138.8773	150.7852	161.9769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	(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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	(71)
Water heating gains (Table 5)	63.2794	61.4176	57.5552	52.3060	48.8975	44.0997	40.0238	45.2484	47.1065	52.5391	58.6738	61.4286	(72)
Total internal gains	304.2294	302.2966	291.2894	273.7359	256.1605	239.1293	228.0315	233.3270	242.3298	260.0668	280.3684	295.3565	(73)

6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
Southeast			7.8600	36.7938	0.4500	0.0000	0.7700	100.2076 (77)				
Solar gains	100.2076	170.6907	233.5464	289.3753	324.1245	321.7806	310.2308	284.3064	252.8814	188.6496	120.0257	85.7569 (83)
Total gains	404.4370	472.9873	524.8358	563.1112	580.2850	560.9099	538.2623	517.6334	495.2112	448.7163	400.3940	381.1134 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046		
alpha	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136		
util living area	0.9962	0.9908	0.9777	0.9412	0.8521	0.6890	0.5175	0.5586	0.7905	0.9554	0.9916	0.9972	(86)	
MIT	19.9121	20.0809	20.3195	20.5968	20.8309	20.9584	20.9922	20.9885	20.9144	20.6101	20.1943	19.8647	(87)	
Th 2	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	(88)	
util rest of house	0.9949	0.9879	0.9702	0.9209	0.8029	0.5997	0.4048	0.4444	0.7119	0.9357	0.9884	0.9963	(89)	
MIT 2	19.0171	19.1845	19.4190	19.6841	19.8906	19.9832	19.9999	19.9987	19.9573	19.7016	19.2980	18.9700	(90)	
Living area fraction									fLA = Living area / (4) =			0.4452	(91)	
MIT	19.4156	19.5836	19.8199	20.0905	20.3093	20.4174	20.4417	20.4394	20.3834	20.1061	19.6971	19.3684	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.2656	19.4336	19.6699	19.9405	20.1593	20.2674	20.2917	20.2894	20.2334	19.9561	19.5471	19.2184	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	401.8896	466.2286	507.5853	517.7487	470.9013	350.4370	235.8871	247.5332	362.4350	419.3908	394.9514	379.3107	(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	963.8922	936.0715	848.2391	711.0879	544.8386	365.0213	237.7740	250.5045	395.0355	602.5999	801.6801	967.2904	(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	418.1299	315.7344	253.4464	139.2042	55.0094	0.0000	0.0000	0.0000	0.0000	136.3075	292.8447	437.4569	(98)	
Space heating												2048.1334	(98)	
Space heating per m2												34.9392	(99)	

8c. Space cooling requirement

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													2263.1308 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.1299	315.7344	253.4464	139.2042	55.0094	0.0000	0.0000	0.0000	0.0000	136.3075	292.8447	437.4569	(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)	462.0220	348.8778	280.0513	153.8168	60.7839	0.0000	0.0000	0.0000	0.0000	150.6161	323.5853	483.3778	(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	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(64)
Efficiency of water heater (217)m	89.6535	89.5569	89.3766	89.0127	88.3233	87.3000	87.3000	87.3000	87.3000	88.9663	89.4893	87.3000	(216)
Fuel for water heating, kWh/month	161.8185	142.1098	147.9761	131.0101	127.7923	113.2118	106.5343	119.9332	120.6772	136.0366	145.7331	157.1172	(219)
Water heating fuel used													1609.9503 (219)
Annual totals kWh/year													
Space heating fuel - main system													2263.1308 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													31.5816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													106.5816 (231)
Electricity for lighting (calculated in Appendix L)													288.9397 (232)
Total delivered energy for all uses													4268.6025 (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	2263.1308	0.2160	488.8363	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1609.9503	0.2160	347.7493	(264)
Space and water heating			836.5855	(265)
Pumps and fans	106.5816	0.5190	55.3159	(267)
Energy for lighting	288.9397	0.5190	149.9597	(268)
Total CO2, kg/year			1041.8611	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7700	(273)

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

DER			17.7700	ZC1
Total Floor Area		TFA	58.6200	
Assumed number of occupants		N	1.9424	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.1298	ZC2
CO2 emissions from cooking, equation (L16)			2.8253	ZC3
Total CO2 emissions			37.7250	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			37.7250	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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1422 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3922 (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) = 0.3039 (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	0.3875	0.3799	0.3723	0.3343	0.3267	0.2887	0.2887	0.2811	0.3039	0.3267	0.3419	0.3571 (22b)
Effective ac	0.5751	0.5722	0.5693	0.5559	0.5534	0.5417	0.5417	0.5395	0.5462	0.5534	0.5585	0.5638 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.8600	1.3258	10.4205		(27)
WT-E-01	33.5500	7.8600	25.6900	0.1800	4.6242		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.1800	4.4136		(29a)
Flat Roof	58.6200		58.6200	0.1300	7.6206		(30)
Total net area of external elements Aum, m ²			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 29.1989		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5641 (36)
Total fabric heat loss							(33) + (36) = 36.7630 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.6992	26.5639	26.4312	25.8080	25.6914	25.1487	25.1487	25.0482	25.3577	25.6914	25.9273	26.1739 (38)
Heat transfer coeff	63.4622	63.3268	63.1941	62.5710	62.4544	61.9116	61.9116	61.8111	62.1207	62.4544	62.6902	62.9368 (39)
Average = Sum(39)m / 12 =												62.5704 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0826	1.0803	1.0780	1.0674	1.0654	1.0562	1.0562	1.0544	1.0597	1.0654	1.0694	1.0736 (40)
HLP (average)												1.0674 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9424 (42)
Average daily hot water use (litres/day)												80.3310 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy conte	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Energy content (annual)												Total = Sum(45)m = 1263.9198 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6562	17.1915	17.7400	15.4662	14.8402	12.8060	11.8666	13.6171	13.7797	16.0589	17.5296	19.0360 (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)

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Combi loss	45.0294	39.1927	41.7545	38.8230	38.4797	35.6538	36.8422	38.4797	38.8230	41.7545	41.9922	45.0294 (61)
Total heat required for water heating calculated for each month	176.0708	153.8024	160.0215	141.9310	137.4142	121.0268	115.9529	129.2603	130.6878	148.8141	158.8561	171.9360 (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	176.0708	153.8024	160.0215	141.9310	137.4142	121.0268	115.9529	129.2603	130.6878	148.8141	158.8561	171.9360 (64)
Heat gains from water heating, kWh/month	54.8286	47.9059	49.7624	43.9892	42.5157	37.3000	35.5148	39.8045	40.2508	46.0359	49.3553	53.4538 (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	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3610	14.5317	11.8179	8.9469	6.6879	5.6462	6.1010	7.9303	10.6440	13.5150	15.7740	16.8157 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.4536	171.2120	166.7809	157.3476	145.4397	134.2480	126.7713	125.0129	129.4440	138.8773	150.7852	161.9769 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118 (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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944 (71)
Water heating gains (Table 5)	73.6944	71.2885	66.8849	61.0960	57.1447	51.8055	47.7350	53.5006	55.9039	61.8763	68.5490	71.8465 (72)
Total internal gains	314.6443	312.1676	300.6191	282.5260	264.4078	246.8352	235.7427	241.5792	251.1273	269.4040	290.2436	305.7744 (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	
-----												7.8600	36.7938		0.6300	0.7000		0.7700		88.3831 (77)		

Solar gains	88.3831	150.5492	205.9879	255.2291	285.8778	283.8105	273.6236	250.7583	223.0414	166.3889	105.8626	75.6375	(83)									
Total gains	403.0275	462.7168	506.6071	537.7550	550.2856	530.6457	509.3663	492.3374	474.1687	435.7929	396.1062	381.4120	(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	64.1458	64.2829	64.4179	65.0595	65.1809	65.7523	65.7523	65.8592	65.5310	65.1809	64.9357	64.6813
alpha	5.2764	5.2855	5.2945	5.3373	5.3454	5.3835	5.3835	5.3906	5.3687	5.3454	5.3290	5.3121
util living area	0.9962	0.9915	0.9801	0.9473	0.8642	0.7003	0.5261	0.5645	0.7975	0.9577	0.9918	0.9972 (86)
MIT	19.9322	20.0901	20.3185	20.5971	20.8287	20.9598	20.9928	20.9895	20.9178	20.6222	20.2219	19.9001 (87)
Th 2	20.0151	20.0170	20.0188	20.0275	20.0292	20.0368	20.0368	20.0382	20.0339	20.0292	20.0259	20.0224 (88)
util rest of house	0.9950	0.9888	0.9734	0.9288	0.8178	0.6132	0.4155	0.4531	0.7213	0.9390	0.9886	0.9962 (89)
MIT 2	18.5984	18.8292	19.1601	19.5587	19.8619	20.0100	20.0341	20.0339	19.9705	19.6009	19.0287	18.5569 (90)
Living area fraction									fLA = Living area / (4) =			0.4452 (91)
MIT	19.1923	19.3906	19.6759	20.0210	20.2924	20.4329	20.4609	20.4594	20.3922	20.0556	19.5599	19.1549 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1923	19.3906	19.6759	20.0210	20.2924	20.4329	20.4609	20.4594	20.3922	20.0556	19.5599	19.1549 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	400.4394	456.4823	491.6634	499.3912	457.6361	345.2331	236.8591	247.6204	356.4896	409.4626	390.7979	379.5357 (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	945.0958	917.6406	832.6373	695.8548	536.6328	361.1240	239.0367	250.9158	390.8786	590.5454	781.1167	941.2170 (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	405.2243	309.8984	253.6846	141.4538	58.7735	0.0000	0.0000	0.0000	0.0000	134.7256	281.0296	417.8909 (98)
Space heating												2002.6808 (98)
Space heating per m ²										(98) / (4) =		34.1638 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2144.1978 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	405.2243	309.8984	253.6846	141.4538	58.7735	0.0000	0.0000	0.0000	0.0000	134.7256	281.0296	417.8909	(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)	433.8590	331.7970	271.6110	151.4495	62.9267	0.0000	0.0000	0.0000	0.0000	144.2458	300.8882	447.4206	(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	176.0708	153.8024	160.0215	141.9310	137.4142	121.0268	115.9529	129.2603	130.6878	148.8141	158.8561	171.9360	(64)
Efficiency of water heater	87.0824	86.7797	86.2060	85.0427	83.0808	80.3000	80.3000	80.3000	80.3000	84.8019	86.4722	87.2027	(216)
Fuel for water heating, kWh/month	202.1888	177.2333	185.6268	166.8937	165.3984	150.7183	144.3996	160.9717	162.7495	175.4844	183.7077	197.1682	(219)
Water heating fuel used												2072.5403	(219)
Annual totals kWh/year													
Space heating fuel - main system												2144.1978	(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)												288.9397	(232)
Total delivered energy for all uses												4580.6779	(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	2144.1978	0.2160	463.1467 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2072.5403	0.2160	447.6687 (264)
Space and water heating			910.8154 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	288.9397	0.5190	149.9597 (268)
Total CO2, kg/m2/year			1099.7002 (272)
Emissions per m2 for space and water heating			15.5376 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5582 (272b)
Emissions per m2 for pumps and fans			0.6640 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5376 * 1.00) + 2.5582 + 0.6640, rounded to 2 d.p.			18.7600 (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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					4.1500
Number of sides sheltered					0.3497 (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) =				0.2710 (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	0.3455	0.3387	0.3320	0.2981	0.2913	0.2574	0.2574	0.2507	0.2710	0.2913	0.3049	0.3184 (22b)
Effective ac	0.5597	0.5574	0.5551	0.5444	0.5424	0.5331	0.5331	0.5314	0.5367	0.5424	0.5465	0.5507 (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)			7.8600	1.2357	9.7129		(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861		(29a)
Flat Roof	58.6200		58.6200	0.1500	8.7930		(30)
Total net area of external elements Aum, m ²			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					32.8500		(32)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Floor 1			58.6200				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3437 (36)
Total fabric heat loss							(33) + (36) =
							41.1937 (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	25.9846	25.8770	25.7715	25.2761	25.1834	24.7520	24.7520	24.6721	24.9182	25.1834	25.3710	25.5670 (38)
Heat transfer coeff	67.1783	67.0707	66.9653	66.4698	66.3772	65.9457	65.9457	65.8658	66.1119	66.3772	66.5647	66.7607 (39)
Average = Sum(39)m / 12 =												66.4694 (39)
HLP	1.1460	1.1442	1.1424	1.1339	1.1323	1.1250	1.1250	1.1236	1.1278	1.1323	1.1355	1.1389 (40)
HLP (average)												1.1339 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9424 (42)
Average daily hot water use (litres/day)												80.3310 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy content (annual)	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Distribution loss (46)m = 0.15 x (45)m												1263.9198 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As 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 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	27.8463	24.3546	25.1317	21.9104	21.0236	18.1418	16.8110	19.2909	19.5213	22.7502	24.8336	26.9677 (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	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3610	14.5317	11.8179	8.9469	6.6879	5.6462	6.1010	7.9303	10.6440	13.5150	15.7740	16.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.4536	171.2120	166.7809	157.3476	145.4397	134.2480	126.7713	125.0129	129.4440	138.8773	150.7852	161.9769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	(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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	(71)
Water heating gains (Table 5)	37.4278	36.2419	33.7792	30.4312	28.2575	25.1969	22.5954	25.9286	27.1129	30.5782	34.4911	36.2469	(72)
Total internal gains	275.3778	274.1209	264.5134	248.8611	232.5206	217.2266	207.6031	211.0072	219.3363	235.1059	253.1856	267.1748	(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

Southeast					7.8600	36.7938	0.4500		0.0000		0.7700		100.2076 (77)	

Solar gains	100.2076	170.6907	233.5464	289.3753	324.1245	321.7806	310.2308	284.3064	252.8814	188.6496	120.0257	85.7569	(83)	
Total gains	375.5854	444.8116	498.0598	538.2364	556.6451	539.0072	517.8339	495.3136	472.2176	423.7554	373.2113	352.9316	(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	60.5974	60.6946	60.7902	61.2433	61.3288	61.7301	61.7301	61.8050	61.5749	61.3288	61.1561	60.9765	
alpha	5.0398	5.0463	5.0527	5.0829	5.0886	5.1153	5.1153	5.1203	5.1050	5.0886	5.0771	5.0651	
util living area	0.9973	0.9933	0.9830	0.9530	0.8758	0.7204	0.5472	0.5915	0.8214	0.9660	0.9940	0.9980	(86)
MIT	19.8019	19.9767	20.2277	20.5318	20.7914	20.9456	20.9891	20.9839	20.8902	20.5484	20.1097	19.7649	(87)
Th 2	19.9634	19.9649	19.9664	19.9732	19.9745	19.9805	19.9805	19.9816	19.9782	19.9745	19.9719	19.9692	(88)
util rest of house	0.9964	0.9910	0.9771	0.9357	0.8301	0.6296	0.4272	0.4706	0.7455	0.9500	0.9916	0.9974	(89)
MIT 2	18.8764	19.0514	19.3004	19.5998	19.8344	19.9556	19.9777	19.9771	19.9194	19.6214	19.1901	18.8442	(90)
Living area fraction	19.2885	19.4634	19.7132	20.0148	20.2605	20.3964	20.4280	20.4254	fLA = Living area / (4) =	20.3516	20.0342	19.5995	0.4452 (91)
MIT	19.2885	19.4634	19.7132	20.0148	20.2605	20.3964	20.4280	20.4254	20.3516	20.0342	19.5995	19.2542	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2885	19.4634	19.7132	20.0148	20.2605	20.3964	20.4280	20.4254	20.3516	20.0342	19.5995	19.2542	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	373.9461	440.1974	485.7443	504.0468	469.9404	360.4121	249.1218	259.9998	366.3932	403.0567	369.6709	351.7873	(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	1006.8999	976.7776	884.8275	738.7961	568.2207	382.2471	252.4417	265.1343	413.3044	626.2128	832.0259	1005.0266	(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	470.9176	360.5819	296.9179	169.0195	73.1206	0.0000	0.0000	0.0000	0.0000	166.0282	332.8956	486.0100	(98)
Space heating												2355.4912	(98)
Space heating per m2												40.1824	(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	619.8893	487.9980	500.5798	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8844	0.9395	0.9252	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	548.2185	458.4981	463.1197	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.2336	677.1099	652.0906	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	111.6109	162.6472	140.5943	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												414.8524	(104)
Cooled fraction												1.0000	(105)

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

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF 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	27.9027	40.6618	35.1486	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											103.7131 (107)
Space cooling per m2											1.7692 (108)
Energy for space heating											40.1824 (99)
Energy for space cooling											1.7692 (108)
Total											41.9516 (109)
Dwelling Fabric Energy Efficiency (DFEE)											42.0 (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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1422 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3922 (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) =	0.3039 (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	0.3875	0.3799	0.3723	0.3343	0.3267	0.2887	0.2887	0.2811	0.3039	0.3267	0.3419	0.3571 (22b)
	0.5751	0.5722	0.5693	0.5559	0.5534	0.5417	0.5417	0.5395	0.5462	0.5534	0.5585	0.5638 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.8600	1.3258	10.4205		(27)
WT-E-01	33.5500	7.8600	25.6900	0.1800	4.6242		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.1800	4.4136		(29a)
Flat Roof	58.6200		58.6200	0.1300	7.6206		(30)
Total net area of external elements Aum, m ²			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.1989	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5641 (36)
Total fabric heat loss						(33) + (36) =	36.7630 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.6992	26.5639	26.4312	25.8080	25.6914	25.1487	25.1487	25.0482	25.3577	25.6914	25.9273	26.1739 (38)
Heat transfer coeff	63.4622	63.3268	63.1941	62.5710	62.4544	61.9116	61.9116	61.8111	62.1207	62.4544	62.6902	62.9368 (39)
Average = Sum(39)m / 12 =												62.5704 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0826	1.0803	1.0780	1.0674	1.0654	1.0562	1.0562	1.0544	1.0597	1.0654	1.0694	1.0736 (40)
HLP (average)												1.0674 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9424 (42)
Average daily hot water use (litres/day)												80.3310 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy conte	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Energy content (annual)												Total = Sum(45)m = 1263.9198 (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	0.0000 (59)
Heat gains from water heating, kWh/month	27.8463	24.3546	25.1317	21.9104	21.0236	18.1418	16.8110	19.2909	19.5213	22.7502	24.8336	26.9677 (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	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	97.1179	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3610	14.5317	11.8179	8.9469	6.6879	5.6462	6.1010	7.9303	10.6440	13.5150	15.7740	16.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.4536	171.2120	166.7809	157.3476	145.4397	134.2480	126.7713	125.0129	129.4440	138.8773	150.7852	161.9769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	32.7118	(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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	(71)
Water heating gains (Table 5)	37.4278	36.2419	33.7792	30.4312	28.2575	25.1969	22.5954	25.9286	27.1129	30.5782	34.4911	36.2469	(72)
Total internal gains	275.3778	274.1209	264.5134	248.8611	232.5206	217.2266	207.6031	211.0072	219.3363	235.1059	253.1856	267.1748	(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		
Southeast	7.8600				36.7938		0.6300		0.7000		0.7700		88.3831 (77)		
Solar gains	88.3831	150.5492	205.9879	255.2291	285.8778	283.8105	273.6236	250.7583	223.0414	166.3889	105.8626	75.6375	(83)		
Total gains	363.7609	424.6701	470.5014	504.0901	518.3984	501.0371	481.2267	461.7654	442.3776	401.4948	359.0482	342.8123	(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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	64.1458	64.2829	64.4179	65.0595	65.1809	65.7523	65.7523	65.8592	65.5310	65.1809	64.9357	64.6813	
alpha	5.2764	5.2855	5.2945	5.3373	5.3454	5.3835	5.3835	5.3906	5.3687	5.3454	5.3290	5.3121	
util living area	0.9977	0.9943	0.9855	0.9587	0.8861	0.7306	0.5543	0.5976	0.8294	0.9694	0.9948	0.9983	(86)
MIT	19.8696	20.0307	20.2652	20.5546	20.8024	20.9508	20.9908	20.9863	20.8994	20.5764	20.1639	19.8382	(87)
Th 2	20.0151	20.0170	20.0188	20.0275	20.0292	20.0368	20.0368	20.0382	20.0339	20.0292	20.0259	20.0224	(88)
util rest of house	0.9969	0.9924	0.9804	0.9435	0.8439	0.6437	0.4391	0.4818	0.7573	0.9550	0.9927	0.9977	(89)
MIT 2	18.9856	19.1474	19.3808	19.6686	19.8945	20.0138	20.0344	20.0343	19.9791	19.6948	19.2878	18.9602	(90)
Living area fraction	19.3792	19.5407	19.7746	20.0631	20.2987	20.4310	20.4602	20.4582	20.3889	20.0873	19.6779	19.3511	(91)
MIT	19.3792	19.5407	19.7746	20.0631	20.2987	20.4310	20.4602	20.4582	20.3889	20.0873	19.6779	19.3511	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3792	19.5407	19.7746	20.0631	20.2987	20.4310	20.4602	20.4582	20.3889	20.0873	19.6779	19.3511	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9912	0.9789	0.9441	0.8569	0.6812	0.4908	0.5338	0.7863	0.9560	0.9917	0.9972	(94)
Useful gains	362.3880	420.9296	460.5689	475.9203	444.2101	341.2969	236.1805	246.4819	347.8308	383.8362	356.0726	341.8526	(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	956.9580	927.1474	838.8753	698.4856	537.0293	361.0076	238.9916	250.8405	390.6704	592.5259	788.5107	953.5626	(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	442.3601	340.1784	281.4600	160.2470	69.0575	0.0000	0.0000	0.0000	0.0000	155.2651	311.3554	455.1122	(98)
Space heating												2215.0356	(98)
Space heating per m2												37.7863	(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	581.9693	458.1460	469.7645	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8906	0.9449	0.9319	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	518.3231	432.9074	437.7562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	658.8530	634.3222	612.8784	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	101.1815	149.8527	130.2910	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												381.3251	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

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	25.2954	37.4632	32.5727	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													95.3313 (107)
Space cooling per m2													1.6263 (108)
Energy for space heating													37.7863 (99)
Energy for space cooling													1.6263 (108)
Total													39.4126 (109)
Target Fabric Energy Efficiency (TFEE)													45.3 (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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (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					4.1500
Number of sides sheltered					0.2075 (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) =	0.1608 (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	0.1689	0.1608	0.1608	0.1488	0.1488	0.1327	0.1367	0.1287	0.1327	0.1407	0.1407	0.1528 (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)			7.8600	1.2357	9.7129		(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861		(29a)
Flat Roof	58.6200		58.6200	0.1500	8.7930		(30)
Total net area of external elements Aum(A, m ²)			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.8500		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Floor 1			58.6200				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3437 (36)
Total fabric heat loss						(33) + (36) =	41.1937 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135 (38)
Heat transfer coeff	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072 (39)
Average = Sum(39)m / 12 =												64.4072 (39)
HLP	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987 (40)
HLP (average)												1.0987 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9424 (42)
Average daily hot water use (litres/day)												80.3310 (43)
Daily hot water use	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy conte	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Energy content (annual)										Total = Sum(45)m =		1263.9198 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6562	17.1915	17.7400	15.4662	14.8402	12.8060	11.8666	13.6171	13.7797	16.0589	17.5296	19.0360 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0345	12.6595	13.9891	13.5076	13.9359	13.4609	13.8938	13.9211	13.4864	13.9671	13.5516	14.0257	(61)
Total heat required for water heating calculated for each month	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(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	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(64)
RHI water heating demand	47.0799	41.2726	42.8210	37.6603	36.3797	31.7518	29.7777	33.6648	33.9166	39.0891	42.2452	45.7029	(65)
Heat gains from water heating, kWh/month													
	47.0799	41.2726	42.8210	37.6603	36.3797	31.7518	29.7777	33.6648	33.9166	39.0891	42.2452	45.7029	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.9024	36.3292	29.5449	22.3674	16.7199	14.1156	15.2524	19.8257	26.6100	33.7875	39.4350	42.0392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.9158	255.5403	248.9267	234.8471	217.0742	200.3702	189.2109	186.5864	193.2000	207.2796	225.0525	241.7565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	(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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	(71)
Water heating gains (Table 5)	63.2794	61.4176	57.5552	52.3060	48.8975	44.0997	40.0238	45.2484	47.1065	52.5391	58.6738	61.4286	(72)
Total internal gains	447.5413	443.7307	426.4704	399.9642	373.1352	349.0292	334.9309	342.1042	357.3601	384.0498	413.6050	435.6680	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	g	Specific data	FF	Access	Gains						
	m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W						
						Table 6d							
Southeast	7.8600	40.4699	0.4500	0.0000	0.7700		110.2194	(77)					
Solar gains	110.2194	168.8930	228.6385	293.3843	321.8731	342.8585	326.6073	304.6829	268.7790	199.3559	135.2254	93.4358	(83)
Total gains	557.7608	612.6237	655.1089	693.3485	695.0084	691.8876	661.5382	646.7871	626.1391	583.4058	548.8304	529.1038	(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)														
tau	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	
alpha	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	
util living area	0.9804	0.9674	0.9336	0.8516	0.6937	0.4608	0.3014	0.3181	0.5796	0.8542	0.9589	0.9843	0.9843	(86)
MIT	20.2282	20.3543	20.5726	20.7988	20.9464	20.9948	20.9996	20.9994	20.9828	20.8268	20.4970	20.1861	20.1861	(87)
Th 2	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	(88)
util rest of house	0.9744	0.9577	0.9142	0.8112	0.6232	0.3712	0.2046	0.2192	0.4875	0.8059	0.9448	0.9794	0.9794	(89)
MIT 2	19.3286	19.4506	19.6579	19.8593	19.9731	20.0004	20.0018	20.0018	19.9954	19.8871	19.5903	19.2877	19.2877	(90)
Living area fraction	19.7291	19.8530	20.0651	20.2776	20.4064	20.4431	20.4461	20.4460	20.4350	20.3055	19.9940	19.6877	19.6877	(91)
MIT	19.7291	19.8530	20.0651	20.2776	20.4064	20.4431	20.4461	20.4460	20.4350	20.3055	19.9940	19.6877	19.6877	(92)
Temperature adjustment	19.5791	19.7030	19.9151	20.1276	20.2564	20.2931	20.2961	20.2960	20.2850	20.1555	19.8440	19.5377	19.5377	(93)
adjusted MIT	19.5791	19.7030	19.9151	20.1276	20.2564	20.2931	20.2961	20.2960	20.2850	20.1555	19.8440	19.5377	19.5377	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9713	0.9543	0.9123	0.8168	0.6421	0.3976	0.2332	0.2484	0.5144	0.8142	0.9421	0.9765	(94)
Ext temp.	541.7312	584.6137	597.6512	566.3475	446.2310	275.1119	154.2638	160.6743	322.0908	475.0050	517.0600	516.6726	(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	932.5610	908.3355	806.0643	658.7305	467.3656	276.5077	154.3237	160.7594	327.5128	551.0370	762.8417	929.8924	(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	290.7774	217.5411	155.0594	66.5158	15.7241	0.0000	0.0000	0.0000	0.0000	56.5679	176.9628	307.4355	(98)
RHI space heating demand												1286.5839	(98)
												1287	(98)

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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (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					4.1500
Infiltration rate					0.2075 (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) =				0.1608 (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	0.2050	0.2010	0.1970	0.1769	0.1729	0.1528	0.1528	0.1488	0.1608	0.1729	0.1809	0.1890 (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)			7.8600	1.2357	9.7129		(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861		(29a)
Flat Roof	58.6200		58.6200	0.1500	8.7930		(30)
Total net area of external elements Aum(A, m2)			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	32.8500	(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Floor 1			58.6200				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3437 (36)
Total fabric heat loss						(33) + (36) =	41.1937 (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	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135 (38)
Average = Sum(39)m / 12 =	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9424 (42)
Average daily hot water use (litres/day)												80.3310 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy content (annual)	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6562	17.1915	17.7400	15.4662	14.8402	12.8060	11.8666	13.6171	13.7797	16.0589	17.5296	19.0360 (46)
	Total = Sum(45)m =										1263.9198 (45)	

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Calculation Type: New Build (As Built)

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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	14.0345	12.6595	13.9891	13.5076	13.9359	13.4609	13.8938	13.9211	13.4864	13.9671	13.5516	14.0257	(61)
Total heat required for water heating calculated for each month	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(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	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(64)
Heat gains from water heating, kWh/month	47.0799	41.2726	42.8210	37.6603	36.3797	31.7518	29.7777	33.6648	33.9166	39.0891	42.2452	45.7029	(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	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.9024	36.3292	29.5449	22.3674	16.7199	14.1156	15.2524	19.8257	26.6100	33.7875	39.4350	42.0392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.9158	255.5403	248.9267	234.8471	217.0742	200.3702	189.2109	186.5864	193.2000	207.2796	225.0525	241.7565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	(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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	(71)
Water heating gains (Table 5)	63.2794	61.4176	57.5552	52.3060	48.8975	44.0997	40.0238	45.2484	47.1065	52.5391	58.6738	61.4286	(72)
Total internal gains	447.5413	443.7307	426.4704	399.9642	373.1352	349.0292	334.9309	342.1042	357.3601	384.0498	413.6050	435.6680	(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

Southeast				7.8600	36.7938	0.4500	0.0000			0.7700				100.2076 (77)

Solar gains	100.2076	170.6907	233.5464	289.3753	324.1245	321.7806	310.2308	284.3064	252.8814	188.6496	120.0257			85.7569 (83)
Total gains	547.7490	614.4214	660.0168	689.3395	697.2597	670.8098	645.1617	626.4106	610.2415	572.6994	533.6306			521.4249 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046		
alpha	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136		
util living area	0.9852	0.9723	0.9457	0.8858	0.7693	0.5948	0.4359	0.4679	0.6842	0.8970	0.9716	0.9884	(86)	
MIT	20.1333	20.2892	20.4991	20.7272	20.8988	20.9787	20.9965	20.9949	20.9566	20.7475	20.3907	20.0835	(87)	
Th 2	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	(88)	
util rest of house	0.9808	0.9644	0.9302	0.8540	0.7114	0.5104	0.3388	0.3690	0.6019	0.8615	0.9620	0.9848	(89)	
MIT 2	19.2352	19.3871	19.5884	19.7976	19.9393	19.9929	20.0010	20.0005	19.9811	19.8205	19.4882	19.1864	(90)	
Living area fraction	19.6351	19.7887	19.9939	20.2115	20.3665	20.4318	20.4442	20.4433	20.4154	20.2333	19.8900	19.5859	(92)	
MIT	19.4851	19.6387	19.8439	20.0615	20.2165	20.2818	20.2942	20.2933	20.2654	20.0833	19.7400	19.4359	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9780	0.9609	0.9273	0.8561	0.7247	0.5348	0.3675	0.3983	0.6247	0.8648	0.9589	0.9823	(94)
Useful gains	535.6889	590.3751	612.0530	590.1683	505.2972	358.7217	237.1058	249.4781	381.2364	495.2777	511.7163	512.2005	(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	978.0276	949.2811	859.4425	718.8796	548.5256	365.9490	237.9355	250.7535	397.0983	610.7900	814.1105	981.2991	(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	329.1000	241.1848	184.0578	92.6721	32.1620	0.0000	0.0000	0.0000	0.0000	85.9411	217.7238	349.0094	(98)
Space heating												1531.8510	(98)
Space heating per m2												26.1319	(99)

8c. Space cooling requirement

Not applicable

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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													1692.6530 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	329.1000	241.1848	184.0578	92.6721	32.1620	0.0000	0.0000	0.0000	0.0000	85.9411	217.7238	349.0094	(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)	363.6464	266.5025	203.3788	102.4002	35.5381	0.0000	0.0000	0.0000	0.0000	94.9625	240.5788	385.6458	(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	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(64)
Efficiency of water heater (217)m	89.4963	89.3685	89.1339	88.6886	87.9899	87.3000	87.3000	87.3000	87.3000	88.6009	89.2741	87.3000	(216)
Fuel for water heating, kWh/month	162.1027	142.4095	148.3791	131.4888	128.2765	113.2118	106.5343	119.9332	120.6772	136.5976	146.0843	157.3683	(219)
Water heating fuel used												1613.0633	(219)
Annual totals kWh/year													
Space heating fuel - main system												1692.6530	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													31.5816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													106.5816 (231)
Electricity for lighting (calculated in Appendix L)													288.9397 (232)
Total delivered energy for all uses													3701.2377 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1692.6530	3.4800	58.9043 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1613.0633	3.4800	56.1346 (247)
Mechanical ventilation fans	31.5816	13.1900	4.1656 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	288.9397	13.1900	38.1111 (250)
Additional standing charges			120.0000 (251)
Total energy cost			287.2082 (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] = 1.1641 (257)
SAP value	83.7603
SAP rating (Section 12)	84 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1692.6530	0.2160	365.6131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1613.0633	0.2160	348.4217 (264)
Space and water heating			714.0347 (265)
Pumps and fans	106.5816	0.5190	55.3159 (267)
Energy for lighting	288.9397	0.5190	149.9597 (268)
Total kg/year			919.3103 (272)
CO2 emissions per m2			15.6800 (273)
EI value			88.1116
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	$3.48 / 0.8844 = 3.935$, stars = 4
Water heating environmental impact	$0.216 / 0.8844 = 0.2442$, 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	58.6200 (1b)	x 2.4000 (2b)	= 140.6880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.6880 (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					4.1500
Infiltration rate					0.2075 (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) = 0.1608 (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	0.1689	0.1608	0.1608	0.1488	0.1488	0.1327	0.1367	0.1287	0.1327	0.1407	0.1407	0.1528 (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)			7.8600	1.2357	9.7129		(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380		(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861		(29a)
Flat Roof	58.6200		58.6200	0.1500	8.7930		(30)
Total net area of external elements Aum(A, m ²)			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.8500		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Floor 1			58.6200				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3437 (36)
Total fabric heat loss							(33) + (36) = 41.1937 (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	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135	23.2135 (38)
Average = Sum(39)m / 12 =	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072	64.4072 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987	1.0987 (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												
Average daily hot water use (litres/day)												1.9424 (42)
												80.3310 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.3641	85.1509	81.9376	78.7244	75.5112	72.2979	72.2979	75.5112	78.7244	81.9376	85.1509	88.3641 (44)
Energy content (annual)	131.0414	114.6097	118.2669	103.1080	98.9346	85.3730	79.1106	90.7806	91.8648	107.0596	116.8639	126.9066 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6562	17.1915	17.7400	15.4662	14.8402	12.8060	11.8666	13.6171	13.7797	16.0589	17.5296	19.0360 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0345	12.6595	13.9891	13.5076	13.9359	13.4609	13.8938	13.9211	13.4864	13.9671	13.5516	14.0257	14.0257	(61)
Total heat required for water heating calculated for each month	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	140.9323	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	140.9323	(64)
Heat gains from water heating, kWh/month	47.0799	41.2726	42.8210	37.6603	36.3797	31.7518	29.7777	33.6648	33.9166	39.0891	42.2452	45.7029	45.7029	(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	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	116.5415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.9024	36.3292	29.5449	22.3674	16.7199	14.1156	15.2524	19.8257	26.6100	33.7875	39.4350	42.0392	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	252.9158	255.5403	248.9267	234.8471	217.0742	200.3702	189.2109	186.5864	193.2000	207.2796	225.0525	241.7565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	48.5965	(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)	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	-77.6944	(71)
Water heating gains (Table 5)	63.2794	61.4176	57.5552	52.3060	48.8975	44.0997	40.0238	45.2484	47.1065	52.5391	58.6738	61.4286	(72)
Total internal gains	447.5413	443.7307	426.4704	399.9642	373.1352	349.0292	334.9309	342.1042	357.3601	384.0498	413.6050	435.6680	(73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains	
				m2	Table 6a	Specific data		Specific data		factor		W	
					W/m2	or Table 6b		or Table 6c		Table 6d			
Southeast				7.8600	40.4699	0.4500		0.0000		0.7700		110.2194 (77)	
Solar gains	110.2194	168.8930	228.6385	293.3843	321.8731	342.8585	326.6073	304.6829	268.7790	199.3559	135.2254	93.4358	(83)
Total gains	557.7608	612.6237	655.1089	693.3485	695.0084	691.8876	661.5382	646.7871	626.1391	583.4058	548.8304	529.1038	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	63.2046	
alpha	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	5.2136	
util living area	0.9804	0.9674	0.9336	0.8516	0.6937	0.4608	0.3014	0.3181	0.5796	0.8542	0.9589	0.9843	(86)
MIT	20.2282	20.3543	20.5726	20.7988	20.9464	20.9948	20.9996	20.9994	20.9828	20.8268	20.4970	20.1861	(87)
Th 2	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	20.0019	(88)
util rest of house	0.9744	0.9577	0.9142	0.8112	0.6232	0.3712	0.2046	0.2192	0.4875	0.8059	0.9448	0.9794	(89)
MIT 2	19.3286	19.4506	19.6579	19.8593	19.9731	20.0004	20.0018	20.0018	19.9954	19.8871	19.5903	19.2877	(90)
Living area fraction									fLA = Living area / (4) =			0.4452	(91)
MIT	19.7291	19.8530	20.0651	20.2776	20.4064	20.4431	20.4461	20.4460	20.4350	20.3055	19.9940	19.6877	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5791	19.7030	19.9151	20.1276	20.2564	20.2931	20.2961	20.2960	20.2850	20.1555	19.8440	19.5377	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9713	0.9543	0.9123	0.8168	0.6421	0.3976	0.2332	0.2484	0.5144	0.8142	0.9421	0.9765	(94)
Useful gains	541.7312	584.6137	597.6512	566.3475	446.2310	275.1119	154.2638	160.6743	322.0908	475.0050	517.0600	516.6726	(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	932.5610	908.3355	806.0643	658.7305	467.3656	276.5077	154.3237	160.7594	327.5128	551.0370	762.8417	929.8924	(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	290.7774	217.5411	155.0594	66.5158	15.7241	0.0000	0.0000	0.0000	0.0000	56.5679	176.9628	307.4355	(98)
Space heating												1286.5839	(98)
Space heating per m2												21.9479	(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													1421.6397 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	290.7774	217.5411	155.0594	66.5158	15.7241	0.0000	0.0000	0.0000	0.0000	56.5679	176.9628	307.4355	(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)	321.3010	240.3769	171.3363	73.4981	17.3747	0.0000	0.0000	0.0000	0.0000	62.5059	195.5390	339.7078	(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	145.0759	127.2692	132.2561	116.6156	112.8704	98.8339	93.0045	104.7017	105.3512	121.0267	130.4155	140.9323	(64)
Efficiency of water heater (217)m	89.4091	89.2919	88.9983	88.4358	87.6791	87.3000	87.3000	87.3000	87.3000	88.2944	89.1141	87.3000	(216)
Fuel for water heating, kWh/month	162.2607	142.5316	148.6051	131.8647	128.7313	113.2118	106.5343	119.9332	120.6772	137.0717	146.3467	157.5206	(219)
Water heating fuel used													1615.2890 (219)
Annual totals kWh/year													
Space heating fuel - main system													1421.6397 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													31.5816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													106.5816 (231)
Electricity for lighting (calculated in Appendix L)													288.9397 (232)
Total delivered energy for all uses													3432.4500 (238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1421.6397	3.6300	51.6055 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1615.2890	3.6300	58.6350 (247)
Mechanical ventilation fans	31.5816	19.4400	6.1395 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	288.9397	19.4400	56.1699 (250)
Additional standing charges			95.0000 (251)
Total energy cost			282.1299 (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	1421.6397	0.2160	307.0742 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1615.2890	0.2160	348.9024 (264)
Space and water heating			655.9766 (265)
Pumps and fans	106.5816	0.5190	55.3159 (267)
Energy for lighting	288.9397	0.5190	149.9597 (268)
Total kg/year			861.2522 (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	1421.6397	1.2200	1734.4004 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1615.2890	1.2200	1970.6525 (264)
Space and water heating			3705.0530 (265)
Pumps and fans	106.5816	3.0700	327.2056 (267)
Energy for lighting	288.9397	3.0700	887.0449 (268)
Primary energy kWh/year			4919.3035 (272)
Primary energy kWh/m2/year			83.9185 (273)

SAP 2012 EPC IMPROVEMENTS

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

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 2022)
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	£77	£77	£0
Mains gas	£205	£205	£0
Space heating	£167	£167	£0
Water heating	£59	£59	£0
Lighting	£56	£56	£0
Total cost of fuels	£282	£282	£0
Total cost of uses	£282	£282	£0
Delivered energy	59 kWh/m²	59 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	84 kWh/m²	84 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	North West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	278.56 (P1)
Transmission heat loss coefficient	41.19 (P7)
Summer heat loss coefficient	319.76 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South East	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
South 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
South East	7.8600	119.9223	0.4500 0.0000
total:			0.9000 381.7488

Solar gains	Jun	Jul	Aug	
Internal gains	401	382	356	(P4)
Total summer gains	346	332	339	
	747	714	695	(P5)
Summer gain/loss ratio	2.34	2.23	2.17	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.59	20.38	20.22	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			