

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025e_053_As_Built				Issued on Date	24/01/2022
Assessment Reference	001	Prop Type Ref	MFF			
Property						
SAP Rating	83 B	DER	18.55	TER	19.82	
Environmental	88 B	% DER<TER	6.43			
CO ₂ Emissions (t/year)	0.90	DFEE	44.92	TFEE	50.78	
General Requirements Compliance	Pass	% DFEE<TFEE	11.54			
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 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) 19.82 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.55 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.9 kWh/m²/yr OK

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	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	(no roof)		
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: 3.77 (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
Air permeability 3.8 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	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					3.7700
Infiltration rate					0.1885 (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) =				0.1461 (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	0.1863	0.1826	0.1790	0.1607	0.1570	0.1388	0.1388	0.1351	0.1461	0.1570	0.1643	0.1717 (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)
FT-03			58.6200	0.1247	7.3071		(28b)
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)
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) =	31.3641		(33)
Party Wall 1				14.8800	0.0000		(32)
Party Ceilings 1				58.6200			(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1053 (36)
Total fabric heat loss							(33) + (36) = 44.4694 (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	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	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830 (39)
Average = Sum(39)m / 12 =												67.6830 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546 (40)
HLP (average)												1.1546 (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)

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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	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	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	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456
alpha	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097
util living area												
	0.9963	0.9913	0.9793	0.9465	0.8656	0.7111	0.5402	0.5818	0.8082	0.9593	0.9920	0.9972 (86)
MIT	19.8356	20.0062	20.2517	20.5422	20.7964	20.9451	20.9887	20.9837	20.8931	20.5623	20.1298	19.7882 (87)
Th 2	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565 (88)
util rest of house												
	0.9950	0.9884	0.9722	0.9273	0.8175	0.6187	0.4188	0.4596	0.7294	0.9406	0.9888	0.9963 (89)
MIT 2	18.9044	19.0736	19.3153	19.5944	19.8213	19.9316	19.9537	19.9520	19.9002	19.6184	19.1973	18.8572 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3190	19.4888	19.7323	20.0164	20.2555	20.3829	20.4145	20.4113	20.3423	20.0386	19.6125	19.2717 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1690	19.3388	19.5823	19.8664	20.1055	20.2329	20.2645	20.2613	20.1923	19.8886	19.4625	19.1217 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9938	0.9862	0.9690	0.9253	0.8252	0.6448	0.4556	0.4966	0.7492	0.9391	0.9869	0.9953 (94)
Useful gains	401.9132	466.4677	508.5745	521.0480	478.8754	361.6780	245.2413	257.0592	371.0300	421.4029	395.1298	379.3095 (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	1006.3784	977.2618	885.4462	742.2409	568.9078	381.2497	248.0251	261.3468	412.3444	628.6832	836.7316	1009.9439 (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	449.7221	343.2536	280.3926	159.2589	66.9841	0.0000	0.0000	0.0000	0.0000	154.2166	317.9533	469.1920 (98)
Space heating												2240.9732 (98)
Space heating per m2										(98) / (4) =		38.2288 (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													2476.2135 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	449.7221	343.2536	280.3926	159.2589	66.9841	0.0000	0.0000	0.0000	0.0000	154.2166	317.9533	469.1920	(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)	496.9305	379.2858	309.8260	175.9767	74.0156	0.0000	0.0000	0.0000	0.0000	170.4050	351.3296	518.4442	(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	89.6981	89.6115	89.4491	89.1191	88.4650	87.3000	87.3000	87.3000	87.3000	89.0645	89.5453	87.3000	(216)
Fuel for water heating, kWh/month	161.7381	142.0232	147.8562	130.8536	127.5877	113.2118	106.5343	119.9332	120.6772	135.8866	145.6420	157.0449	(219)
Water heating fuel used												1608.9887	(219)
Annual totals kWh/year													
Space heating fuel - main system												2476.2135	(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													4480.7236 (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	2476.2135	0.2160	534.8621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1608.9887	0.2160	347.5416	(264)
Space and water heating			882.4037	(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			1087.6793	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.5500	(273)

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

DER			18.5500	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			38.5050	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			38.5050	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) =				Air changes per hour
Pressure test					20.0000 / (5) =
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	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)
FT-03			58.6200	0.1300	7.6206		(28b)
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)
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) =	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)							12.3257 (36)
Total fabric heat loss						(33) + (36) =	41.5246 (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	68.2238	68.0884	67.9557	67.3326	67.2160	66.6732	66.6732	66.5727	66.8823	67.2160	67.4518	67.6984 (39)
Average = Sum(39)m / 12 =												67.3320 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1638	1.1615	1.1593	1.1486	1.1466	1.1374	1.1374	1.1357	1.1409	1.1466	1.1507	1.1549 (40)
HLP (average)												1.1486 (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

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	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, 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	59.6689	59.7875	59.9042	60.4586	60.5635	61.0565	61.0565	61.1487	60.8656	60.5635	60.3517	60.1319
alpha	4.9779	4.9858	4.9936	5.0306	5.0376	5.0704	5.0704	5.0766	5.0577	5.0376	5.0234	5.0088
util living area	0.9963	0.9921	0.9821	0.9542	0.8827	0.7331	0.5605	0.5996	0.8234	0.9630	0.9923	0.9972 (86)
MIT	19.8209	19.9813	20.2198	20.5167	20.7766	20.9394	20.9874	20.9823	20.8860	20.5522	20.1277	19.7883 (87)
Th 2	19.9490	19.9509	19.9527	19.9613	19.9629	19.9704	19.9704	19.9718	19.9675	19.9629	19.9597	19.9563 (88)
util rest of house	0.9951	0.9895	0.9759	0.9372	0.8382	0.6419	0.4373	0.4767	0.7473	0.9458	0.9893	0.9963 (89)
MIT 2	18.3888	18.6234	18.9693	19.3961	19.7419	19.9294	19.9657	19.9645	19.8780	19.4530	18.8439	18.3464 (90)
Living area fraction	19.0265	19.2280	19.5261	19.8950	20.2026	20.3791	20.4206	20.4177	20.3268	19.9424	19.4155	18.9884 (92)
Temperature adjustment	19.0265	19.2280	19.5261	19.8950	20.2026	20.3791	20.4206	20.4177	20.3268	19.9424	19.4155	18.9884 (93)
adjusted MIT	19.0265	19.2280	19.5261	19.8950	20.2026	20.3791	20.4206	20.4177	20.3268	19.9424	19.4155	18.9884 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	400.4585	456.7471	492.7684	503.2748	467.6030	361.0009	250.8815	261.8131	368.1644	411.9965	391.0272	379.5274 (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	1004.6947	975.5700	885.1983	740.3239	571.5080	385.3114	254.7324	267.4688	416.4622	627.9594	830.7061	1001.1496 (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	449.5517	348.6490	291.9678	170.6754	77.3053	0.0000	0.0000	0.0000	0.0000	160.6764	316.5688	462.4869 (98)
Space heating												2277.8814 (98)
Space heating per m ²												38.8584 (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													2438.8451 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	449.5517	348.6490	291.9678	170.6754	77.3053	0.0000	0.0000	0.0000	0.0000	160.6764	316.5688	462.4869	(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)	481.3188	373.2859	312.5994	182.7359	82.7680	0.0000	0.0000	0.0000	0.0000	172.0304	338.9388	495.1680	(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	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	87.3094	87.0485	86.5461	85.5165	83.6654	80.3000	80.3000	80.3000	80.3000	85.2445	86.7540	87.4201	(216)
Fuel for water heating, kWh/month	201.6631	176.6859	184.8974	165.9692	164.2426	150.7183	144.3996	160.9717	162.7495	174.5732	183.1110	196.6780	(219)
Water heating fuel used												2066.6594	(219)
Annual totals kWh/year													
Space heating fuel - main system												2438.8451	(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												4869.4442	(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	2438.8451	0.2160	526.7905 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2066.6594	0.2160	446.3984 (264)
Space and water heating			973.1890 (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			1162.0737 (272)
Emissions per m2 for space and water heating			16.6017 (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) = (16.6017 * 1.00) + 2.5582 + 0.6640, rounded to 2 d.p.			19.8200 (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 * 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					3.7700
Number of sides sheltered					0.3307 (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) =				0.2563 (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	0.3267	0.3203	0.3139	0.2819	0.2755	0.2434	0.2434	0.2370	0.2563	0.2755	0.2883	0.3011 (22b)
Effective ac	0.5534	0.5513	0.5493	0.5397	0.5379	0.5296	0.5296	0.5281	0.5328	0.5379	0.5416	0.5453 (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)
FT-03			58.6200	0.1247	7.3071		(28b)
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)
Total net area of external elements Aum, m ²			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					31.3641		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Ceilings 1			58.6200				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1053 (36)
Total fabric heat loss						(33) + (36) =	44.4694 (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	25.6917	25.5954	25.5011	25.0581	24.9752	24.5893	24.5893	24.5178	24.7379	24.9752	25.1429	25.3182 (38)
Heat transfer coeff	70.1611	70.0649	69.9705	69.5275	69.4446	69.0587	69.0587	68.9873	69.2074	69.4446	69.6123	69.7876 (39)
Average = Sum(39)m / 12 =												69.5271 (39)
HLP	1.1969	1.1952	1.1936	1.1861	1.1847	1.1781	1.1781	1.1769	1.1806	1.1847	1.1875	1.1905 (40)
HLP (average)												1.1861 (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	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)

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	58.0212	58.1009	58.1793	58.5500	58.6199	58.9474	58.9474	59.0085	58.8208	58.6199	58.4787	58.3318	
alpha	4.8681	4.8734	4.8786	4.9033	4.9080	4.9298	4.9298	4.9339	4.9214	4.9080	4.8986	4.8888	
util living area	0.9973	0.9935	0.9839	0.9566	0.8861	0.7398	0.5685	0.6131	0.8357	0.9685	0.9942	0.9980	(86)
MIT	19.7338	19.9097	20.1663	20.4805	20.7570	20.9311	20.9849	20.9782	20.8680	20.5035	20.0507	19.6956	(87)
Th 2	19.9225	19.9238	19.9251	19.9312	19.9323	19.9376	19.9376	19.9386	19.9355	19.9323	19.9300	19.9276	(88)
util rest of house	0.9964	0.9913	0.9782	0.9401	0.8416	0.6468	0.4405	0.4851	0.7603	0.9532	0.9918	0.9974	(89)
MIT 2	18.7758	18.9518	19.2064	19.5157	19.7680	19.9057	19.9338	19.9325	19.8641	19.5436	19.0978	18.7418	(90)
Living area fraction										fLA = Living area / (4) =		0.4452	(91)
MIT	19.2023	19.3783	19.6338	19.9453	20.2083	20.3622	20.4018	20.3981	20.3110	19.9710	19.5221	19.1665	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2023	19.3783	19.6338	19.9453	20.2083	20.3622	20.4018	20.3981	20.3110	19.9710	19.5221	19.1665	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	373.9337	440.2816	486.2466	506.1154	475.6634	369.9749	257.9159	268.7965	372.9646	404.2023	369.7274	351.7683	(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	1045.5628	1014.4197	918.9782	767.9503	590.8586	397.9333	262.5464	275.8167	429.8504	650.7647	864.7314	1044.4741	(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	499.6921	385.8208	321.9523	188.5211	85.7052	0.0000	0.0000	0.0000	0.0000	183.4424	356.4029	515.3731	(98)
Space heating												2536.9099	(98)
Space heating per m2											(98) / (4) =	43.2772	(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	649.1522	511.0347	524.3034	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8628	0.9245	0.9080	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	560.0907	472.4565	476.0508	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	103.0629	152.2622	130.9736	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												386.2987	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

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	0.0000	25.7657	38.0655	32.7434	0.0000	0.0000	0.0000 (107)
Space cooling											96.5747 (107)
Space cooling per m2											1.6475 (108)
Energy for space heating											43.2772 (99)
Energy for space cooling											1.6475 (108)
Total											44.9247 (109)
Dwelling Fabric Energy Efficiency (DFEE)											44.9 (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)
FT-03			58.6200	0.1300	7.6206		(28b)
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)
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) =	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)							12.3257 (36)
Total fabric heat loss						(33) + (36) =	41.5246 (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	68.2238	68.0884	67.9557	67.3326	67.2160	66.6732	66.6732	66.5727	66.8823	67.2160	67.4518	67.6984 (39)
Average = Sum(39)m / 12 =												67.3320 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1638	1.1615	1.1593	1.1486	1.1466	1.1374	1.1374	1.1357	1.1409	1.1466	1.1507	1.1549 (40)
HLP (average)												1.1486 (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												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	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)
	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	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	0.6300	0.7000	0.7700	88.3831 (77)
Solar gains	88.3831	150.5492	205.9879	255.2291	285.8778	283.8105	273.6236
Total gains	363.7609	424.6701	470.5014	504.0901	518.3984	501.0371	481.2267

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	59.6689	59.7875	59.9042	60.4586	60.5635	61.0565	61.0565	61.1487	60.8656	60.5635	60.3517	60.1319
util living area	4.9779	4.9858	4.9936	5.0306	5.0376	5.0704	5.0704	5.0766	5.0577	5.0376	5.0234	5.0088
MIT	0.9977	0.9946	0.9868	0.9639	0.9018	0.7618	0.5893	0.6329	0.8521	0.9730	0.9950	0.9983 (86)
Th 2	19.7592	19.9227	20.1666	20.4731	20.7473	20.9277	20.9843	20.9776	20.8643	20.5056	20.0704	19.7273 (87)
util rest of house	19.9490	19.9509	19.9527	19.9613	19.9629	19.9704	19.9704	19.9718	19.9675	19.9629	19.9597	19.9563 (88)
MIT 2	0.9969	0.9927	0.9821	0.9499	0.8617	0.6720	0.4617	0.5062	0.7812	0.9597	0.9930	0.9977 (89)
Living area fraction	18.8224	18.9865	19.2296	19.5351	19.7887	19.9361	19.9663	19.9653	19.8924	19.5717	19.1413	18.7963 (90)
MIT	19.2395	19.4033	19.6468	19.9527	20.2155	20.3776	20.4196	20.4160	20.3251	19.9875	19.5550	19.2108 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2395	19.4033	19.6468	19.9527	20.2155	20.3776	20.4196	20.4160	20.3251	19.9875	19.5550	19.2108 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9962	0.9915	0.9803	0.9497	0.8728	0.7100	0.5191	0.5632	0.8086	0.9601	0.9919	0.9971 (94)
Ext temp.	362.3722	421.0441	461.2435	478.7567	452.4556	355.7572	249.8024	260.0697	357.7115	385.4756	356.1572	341.8279 (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	1019.2287	987.5079	893.3996	744.2087	572.3793	385.2104	254.6624	267.3566	416.3496	630.9926	840.1095	1016.2088 (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	488.7012	380.6637	321.5241	191.1255	89.2232	0.0000	0.0000	0.0000	0.0000	182.6647	348.4456	501.7394 (98)
Space heating per m2												2504.0874 (98)
												(98) / (4) = 42.7173 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful 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 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												338.0017 (104)
Intermittency factor (Table 10b)												1.0000 (105)
	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	22.0932	33.5035	28.9037	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												84.5004 (107)
Space cooling per m2												1.4415 (108)
Energy for space heating												42.7173 (99)
Energy for space cooling												1.4415 (108)
Total												44.1588 (109)
Target Fabric Energy Efficiency (TFEE)												50.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					3.7700
Infiltration rate					0.1885 (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) =				0.1461 (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	0.1534	0.1461	0.1461	0.1351	0.1351	0.1205	0.1242	0.1169	0.1205	0.1278	0.1278	0.1388 (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)
FT-03			58.6200	0.1247	7.3071		(28b)
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)
Total net area of external elements Aum(A, m2)			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3641		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Ceilings 1			58.6200				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1053 (36)
Total fabric heat loss						(33) + (36) =	44.4694 (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	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	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830 (39)
Average = Sum(39)m / 12 =												67.6830 (39)
HLP	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546 (40)
HLP (average)												1.1546 (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)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	
alpha	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	
util living area	0.9817	0.9700	0.9397	0.8652	0.7156	0.4821	0.3165	0.3339	0.6030	0.8675	0.9624	0.9853 (86)	
MIT	20.1539	20.2827	20.5120	20.7576	20.9294	20.9922	20.9993	20.9990	20.9759	20.7917	20.4371	20.1118 (87)	
Th 2	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565 (88)	
util rest of house	0.9761	0.9609	0.9213	0.8258	0.6431	0.3850	0.2103	0.2256	0.5051	0.8204	0.9491	0.9806 (89)	
MIT 2	19.2183	19.3434	19.5622	19.7835	19.9182	19.9542	19.9564	19.9564	19.9474	19.8173	19.4949	19.1774 (90)	
Living area fraction									fLA = Living area / (4) =			0.4452 (91)	
MIT	19.6349	19.7616	19.9851	20.2172	20.3685	20.4164	20.4207	20.4206	20.4053	20.2512	19.9144	19.5934 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	19.4849	19.6116	19.8351	20.0672	20.2185	20.2664	20.2707	20.2706	20.2553	20.1012	19.7644	19.4434 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	542.6074	586.4347	601.9288	575.7898	460.3470	286.6370	160.3579	167.0772	334.4380	482.9307	519.2314	517.2874	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	973.6104	948.3476	841.6441	688.1465	488.5673	288.7605	160.4585	167.2186	342.1602	575.3834	796.2474	970.8069	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	320.6662	243.2055	178.3482	80.8968	20.9959	0.0000	0.0000	0.0000	0.0000	68.7848	199.4515	337.4185	(98)
Space heating												1449.7675	(98)
RHI space heating demand												1450	(98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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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					3.7700
Number of sides sheltered					0.1885 (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) =	0.1461 (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	0.1863	0.1826	0.1790	0.1607	0.1570	0.1388	0.1388	0.1351	0.1461	0.1570	0.1643	0.1717 (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)
FT-03			58.6200	0.1247	7.3071		(28b)
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)
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) =	31.3641		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Ceilings 1			58.6200				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1053 (36)
Total fabric heat loss						(33) + (36) =	44.4694 (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	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	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830 (39)
Average = Sum(39)m / 12 =												67.6830 (39)
HLP	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546 (40)
HLP (average)												1.1546 (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)

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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	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456		
alpha	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097		
util living area	0.9861	0.9745	0.9506	0.8965	0.7883	0.6182	0.4564	0.4894	0.7065	0.9067	0.9739	0.9890	(86)	
MIT	20.0553	20.2141	20.4333	20.6783	20.8722	20.9704	20.9946	20.9923	20.9425	20.7044	20.3259	20.0053	(87)	
Th 2	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	(88)	
util rest of house	0.9819	0.9669	0.9359	0.8659	0.7301	0.5288	0.3509	0.3823	0.6212	0.8725	0.9647	0.9856	(89)	
MIT 2	19.1212	19.2762	19.4873	19.7140	19.8768	19.9440	19.9552	19.9545	19.9288	19.7427	19.3877	19.0720	(90)	
Living area fraction									fLA = Living area / (4) =			0.4452	(91)	
MIT	19.5371	19.6938	19.9085	20.1434	20.3200	20.4010	20.4180	20.4166	20.3802	20.1709	19.8054	19.4876	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.3871	19.5438	19.7585	19.9934	20.1700	20.2510	20.2680	20.2666	20.2302	20.0209	19.6554	19.3376	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	536.2680	591.8660	615.5339	597.7179	518.0111	372.2732	246.9802	259.7693	393.5851	501.0960	513.0775	512.5873	(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	1021.1389	991.1353	897.3762	750.8309	573.2748	382.4742	248.2611	261.7024	414.9080	637.6326	849.7867	1024.5551	(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	360.7440	268.3090	209.6907	110.2414	41.1162	0.0000	0.0000	0.0000	0.0000	101.5832	242.4307	380.9041	(98)
Space heating												1715.0192	(98)
Space heating per m2												29.2566	(99)

8c. Space cooling requirement

Not applicable

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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												1895.0488	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	360.7440	268.3090	209.6907	110.2414	41.1162	0.0000	0.0000	0.0000	0.0000	101.5832	242.4307	380.9041	(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)	398.6121	296.4740	231.7024	121.8137	45.4323	0.0000	0.0000	0.0000	0.0000	112.2467	267.8792	420.8885	(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	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												87.3000	(216)
(217)m	89.5585	89.4452	89.2349	88.8263	88.1321	87.3000	87.3000	87.3000	87.3000	88.7317	89.3544	89.6129	(217)
Fuel for water heating, kWh/month													
	161.9902	142.2874	148.2112	131.2850	128.0696	113.2118	106.5343	119.9332	120.6772	136.3962	145.9532	157.2680	(219)
Water heating fuel used												1611.8173	(219)
Annual totals kWh/year													
Space heating fuel - main system												1895.0488	(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												3902.3874	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1895.0488	3.4800	65.9477 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1611.8173	3.4800	56.0912 (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			294.2082 (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] = 1.1925 (257)
SAP value	83.3645
SAP rating (Section 12)	83 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1895.0488	0.2160	409.3305 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1611.8173	0.2160	348.1525 (264)
Space and water heating			757.4831 (265)
Pumps and fans	106.5816	0.5190	55.3159 (267)
Energy for lighting	288.9397	0.5190	149.9597 (268)
Total kg/year			962.7586 (272)
CO2 emissions per m2			16.4200 (273)
EI value			87.5497
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	$3.48 / 0.8851 = 3.932$, stars = 4
Water heating environmental impact	$0.216 / 0.8851 = 0.2440$, 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					3.7700
Infiltration rate					0.1885 (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) =				0.1461 (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	0.1534	0.1461	0.1461	0.1351	0.1351	0.1205	0.1242	0.1169	0.1205	0.1278	0.1278	0.1388 (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)
FT-03			58.6200	0.1247	7.3071		(28b)
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)
Total net area of external elements Aum(A, m2)			118.8100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.3641		(33)
Party Wall 1			14.8800	0.0000	0.0000		(32)
Party Ceilings 1			58.6200				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1053 (36)
Total fabric heat loss							(33) + (36) = 44.4694 (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	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	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830	67.6830 (39)
Average = Sum(39)m / 12 =												67.6830 (39)
HLP	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546	1.1546 (40)
HLP (average)												1.1546 (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 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	(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	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	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456	60.1456		
alpha	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097	5.0097		
util living area	0.9817	0.9700	0.9397	0.8652	0.7156	0.4821	0.3165	0.3339	0.6030	0.8675	0.9624	0.9853	(86)	
MIT	20.1539	20.2827	20.5120	20.7576	20.9294	20.9922	20.9993	20.9990	20.9759	20.7917	20.4371	20.1118	(87)	
Th 2	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	19.9565	(88)	
util rest of house	0.9761	0.9609	0.9213	0.8258	0.6431	0.3850	0.2103	0.2256	0.5051	0.8204	0.9491	0.9806	(89)	
MIT 2	19.2183	19.3434	19.5622	19.7835	19.9182	19.9542	19.9564	19.9564	19.9474	19.8173	19.4949	19.1774	(90)	
Living area fraction									fLA = Living area / (4) =			0.4452	(91)	
MIT	19.6349	19.7616	19.9851	20.2172	20.3685	20.4164	20.4207	20.4206	20.4053	20.2512	19.9144	19.5934	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.4849	19.6116	19.8351	20.0672	20.2185	20.2664	20.2707	20.2706	20.2553	20.1012	19.7644	19.4434	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9728	0.9573	0.9188	0.8304	0.6624	0.4143	0.2424	0.2583	0.5341	0.8278	0.9461	0.9777	(94)
Useful gains	542.6074	586.4347	601.9288	575.7898	460.3470	286.6370	160.3579	167.0772	334.4380	482.9307	519.2314	517.2874	(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	973.6104	948.3476	841.6441	688.1465	488.5673	288.7605	160.4585	167.2186	342.1602	575.3834	796.2474	970.8069	(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	320.6662	243.2055	178.3482	80.8968	20.9959	0.0000	0.0000	0.0000	0.0000	68.7848	199.4515	337.4185	(98)
Space heating												1449.7675	(98)
Space heating per m2												24.7316	(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													1601.9530 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	320.6662	243.2055	178.3482	80.8968	20.9959	0.0000	0.0000	0.0000	0.0000	68.7848	199.4515	337.4185	(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)	354.3273	268.7353	197.0699	89.3887	23.1999	0.0000	0.0000	0.0000	0.0000	76.0053	220.3884	372.8381	(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	89.4783	89.3746	89.1092	88.5829	87.7868	87.3000	87.3000	87.3000	87.3000	88.4331	89.2072	87.3000	(216)
Fuel for water heating, kWh/month	162.1352	142.3998	148.4202	131.6457	128.5733	113.2118	106.5343	119.9332	120.6772	136.8567	146.1939	157.4081	(219)
Water heating fuel used													1613.9895 (219)
Annual totals kWh/year													
Space heating fuel - main system													1601.9530 (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													3611.4638 (238)

10a. Fuel costs - using BEDF prices (488)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1601.9530	3.6300	58.1509 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1613.9895	3.6300	58.5878 (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			288.6281 (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	1601.9530	0.2160	346.0218 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1613.9895	0.2160	348.6217 (264)
Space and water heating			694.6436 (265)
Pumps and fans	106.5816	0.5190	55.3159 (267)
Energy for lighting	288.9397	0.5190	149.9597 (268)
Total kg/year			899.9192 (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	1601.9530	1.2200	1954.3827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1613.9895	1.2200	1969.0672 (264)
Space and water heating			3923.4498 (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			5137.7004 (272)
Primary energy kWh/m2/year			87.6442 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
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 83
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 488 TEST (12 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	£212	£212	£0
Space heating	£174	£174	£0
Water heating	£59	£59	£0
Lighting	£56	£56	£0
Total cost of fuels	£289	£289	£0
Total cost of uses	£289	£289	£0
Delivered energy	62 kWh/m²	62 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	88 kWh/m²	88 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	44.47 (37)
Summer heat loss coefficient	323.03 (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

	Jun	Jul	Aug	
Solar gains	401	382	356	(P4)
Internal gains	346	332	339	
Total summer gains	747	714	695	(P5)
Summer gain/loss ratio	2.31	2.21	2.15	(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	18.56	20.36	20.20	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			