FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Property Reference	SECPMW027e_111_As_Built	**Issued on Date**	17/09/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	86 B	**DER**	13.46	**TER**	15.53
Environmental	90 B	**% DER<TER**	13.33		
CO_2 Emissions (t/year)	0.81	**DFEE**	27.93	**TFEE**	34.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.69		

Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk	**Assessor ID**	d168-0001
Client	Bellway Homes Thames Valley		

Regs Region: England
Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 73 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) 15.53 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.46 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 3.51 (measured in this dwelling)
Maximum 10.0 OK

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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

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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

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

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9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing West: 10.22 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.5 m³/m²h

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5100	
Infiltration rate		0.1755	(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) =	0.1360	(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	0.1734	0.1700	0.1666	0.1496	0.1462	0.1292	0.1292	0.1258	0.1360	0.1462	0.1530	0.1598	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1600	3.5024			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1584	3.1240			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.3757			(33)
Party Wall 1			17.7000	0.0000	0.0000			(32)
Party Wall 2			17.7000	0.0000	0.0000			(32)
Party Floor 1			72.3300					(32d)
Party Ceilings 1			73.2300					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0980	(36)
Total fabric heat loss					(33) + (36) =		28.4737	(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	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	(38)
Heat transfer coeff	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	(39)
Average = Sum(39)m / 12 =												57.4728	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	(40)
HLP (average)												0.7848	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	21.8620	19.1206	19.7308	17.2018	16.5055	14.2430	13.1982	15.1452	15.3261	17.8610	19.4967	21.1722	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1003	12.7150	14.0443	13.5538	13.9784	13.4960	13.9264	13.9601	13.5275	14.0170	13.6082	14.0895	(61)
Total heat required for water heating calculated for each month	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.7708	(64)
Heat gains from water heating, kWh/month	51.9858	45.5628	47.2477	41.5191	40.0818	34.9460	32.7377	37.0618	37.3546	43.0962	46.6198	50.4540	(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	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.5929	17.4022	14.1524	10.7143	8.0091	6.7616	7.3061	9.4968	12.7466	16.1847	18.8899	20.1374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7153	206.8396	201.4864	190.0901	175.7044	162.1838	153.1512	151.0269	156.3801	167.7764	182.1621	195.6827	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	(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)	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	(71)
Water heating gains (Table 5)	69.8734	67.8019	63.5049	57.6654	53.8734	48.5361	44.0023	49.8143	51.8814	57.9250	64.7497	67.8146	(72)
Total internal gains	355.0104	352.8725	339.9726	319.2986	298.4157	278.3103	265.2884	271.1668	281.8369	302.7149	326.6306	344.4635	(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	
West	10.2200	19.6403	0.4500	0.0000	0.7700	69.5507	(80)

Solar gains	69.5507	136.0559	224.0647	326.7850	400.4873	409.9700	390.3082	335.2689	260.5965	161.4418	86.7215	57.1951	(83)
Total gains	424.5611	488.9284	564.0373	646.0836	698.9030	688.2803	655.5966	606.4357	542.4334	464.1567	413.3521	401.6586	(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	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	
alpha	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	
util living area	0.9980	0.9942	0.9771	0.9031	0.7326	0.5311	0.3854	0.4351	0.7063	0.9548	0.9949	0.9986	(86)
MIT	20.2635	20.3966	20.6122	20.8462	20.9691	20.9969	20.9997	20.9993	20.9816	20.7877	20.4674	20.2245	(87)
Th 2	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	(88)
util rest of house	0.9974	0.9924	0.9701	0.8782	0.6846	0.4717	0.3213	0.3662	0.6409	0.9372	0.9929	0.9982	(89)
MIT 2	19.5875	19.7198	19.9313	20.1485	20.2475	20.2651	20.2664	20.2663	20.2572	20.1009	19.7908	19.5487	(90)
Living area fraction									fLA = Living area / (4) =			0.3516	(91)
MIT	19.8252	19.9577	20.1707	20.3938	20.5012	20.5224	20.5243	20.5241	20.5119	20.3424	20.0287	19.7864	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6752	19.8077	20.0207	20.2438	20.3512	20.3724	20.3743	20.3741	20.3619	20.1924	19.8787	19.6364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9909	0.9673	0.8773	0.6904	0.4804	0.3308	0.3763	0.6498	0.9351	0.9916	0.9977	(94)
Useful gains	423.1529	484.4976	545.6168	566.8226	482.5157	330.6365	216.8473	228.2317	352.4551	434.0303	409.8890	400.7283	(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	883.6572	856.7900	777.0735	651.9625	497.2106	331.7583	216.9177	228.4007	359.8905	551.3019	734.4274	887.1708	(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	342.6152	250.1805	172.2038	61.3007	10.9330	0.0000	0.0000	0.0000	0.0000	87.2500	233.6677	361.9132	(98)
Space heating												1520.0641	(98)
Space heating per m2											(98) / (4) =	20.7574	(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)
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	1679.6288	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	342.6152	250.1805	172.2038	61.3007	10.9330	0.0000	0.0000	0.0000	0.0000	87.2500	233.6677	361.9132	(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)													
	378.5803	276.4425	190.2804	67.7356	12.0807	0.0000	0.0000	0.0000	0.0000	96.4088	258.1963	399.9041	(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													
	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.4568	89.3242	89.0054	88.3099	87.5508	87.3000	87.3000	87.3000	87.3000	88.5397	89.2548	89.5151	(217)
Fuel for water heating, kWh/month													
	178.6862	156.9407	163.5663	145.2071	141.6494	124.2262	116.7407	131.6471	132.5329	150.3175	160.8725	173.4204	(219)
Water heating fuel used												1775.8068	(219)
Annual totals kWh/year													
Space heating fuel - main system												1679.6288	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)

mechanical ventilation fans (SFP = 0.1840)	39.4528	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.4528	(231)
Electricity for lighting (calculated in Appendix L)	346.0160	(232)
Total delivered energy for all uses	3915.9044	(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	1679.6288	0.2160	362.7998	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1775.8068	0.2160	383.5743	(264)
Space and water heating			746.3741	(265)
Pumps and fans	114.4528	0.5190	59.4010	(267)
Energy for lighting	346.0160	0.5190	179.5823	(268)
Total CO2, kg/year			985.3574	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4600	(273)

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

DER		13.4600	ZC1
Total Floor Area	TFA	73.2300	
Assumed number of occupants	N	2.3219	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5656	ZC2
CO2 emissions from cooking, equation (L16)		2.3860	ZC3
Total CO2 emissions		32.4116	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		32.4116	ZC8

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1707	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4207	(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) =	0.3260	(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	0.4157	0.4075	0.3994	0.3586	0.3505	0.3097	0.3097	0.3016	0.3260	0.3505	0.3668	0.3831	(22b)
Effective ac	0.5864	0.5830	0.5798	0.5643	0.5614	0.5480	0.5480	0.5455	0.5532	0.5614	0.5673	0.5734	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			10.2200	1.3258	13.5492			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1800	3.9402			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1800	3.5496			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1590			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5327	(36)
Total fabric heat loss					(33) + (36) =		28.6917	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.0103	33.8157	33.6250	32.7291	32.5615	31.7812	31.7812	31.6367	32.0817	32.5615	32.9005	33.2550	(38)
Heat transfer coeff	62.7020	62.5074	62.3167	61.4208	61.2532	60.4729	60.4729	60.3284	60.7735	61.2532	61.5923	61.9468	(39)
Average = Sum(39)m / 12 =												61.4200	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8562	0.8536	0.8510	0.8387	0.8364	0.8258	0.8258	0.8238	0.8299	0.8364	0.8411	0.8459	(40)
HLP (average)												0.8387	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(45)
Distribution loss (46)m = 0.15 x (45)m	21.8620	19.1206	19.7308	17.2018	16.5055	14.2430	13.1982	15.1452	15.3261	17.8610	19.4967	21.1722	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.0825	43.5909	46.4401	43.1796	42.7978	39.6548	40.9766	42.7978	43.1796	46.4401	46.7045	50.0825	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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Total heat required for water heating calculated for each month
                195.8291   171.0618   177.9787   157.8582   152.8346   134.6081   128.9649   143.7656   145.3533   165.5137   176.6826   191.2303 (62)
Solar input       0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
                195.8291   171.0618   177.9787   157.8582   152.8346   134.6081   128.9649   143.7656   145.3533   165.5137   176.6826   191.2303 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1941.6811 (64)
Heat gains from water heating, kWh/month
                 60.9814    53.2818    55.3466    48.9255    47.2867    41.4857    39.5002    44.2712    44.7677    51.2020    54.8939    59.4523 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m           116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                 19.5929    17.4022    14.1524    10.7143     8.0091     6.7616     7.3061     9.4968    12.7466    16.1847    18.8899    20.1374 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
                204.7153   206.8396   201.4864   190.0901   175.7044   162.1838   153.1512   151.0269   156.3801   167.7764   182.1621   195.6827 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                 34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096 (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)
                -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768 (71)
Water heating gains (Table 5)
                 81.9642    79.2884    74.3906    67.9521    63.5574    57.6190    53.0917    59.5044    62.1773    68.8199    76.2415    79.9090 (72)
Total internal gains
                367.1012   364.3590   350.8583   329.5854   308.0996   287.3932   274.3779   280.8569   292.1328   313.6098   338.1223   356.5579 (73)


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6. Solar gains
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[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
---------------------------------------------------------------------------------------------------------------------------------
West                                     10.2200          19.6403          0.6300          0.7000          0.7700         61.3437 (80)
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Solar gains     61.3437   120.0013   197.6251   288.2244   353.2298   361.5935   344.2518   295.7072   229.8461   142.3917    76.4884    50.4461 (83)
Total gains    428.4449   484.3603   548.4833   617.8097   661.3294   648.9868   618.6297   576.5641   521.9789   456.0014   414.6107   407.0040 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                    21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau             81.1045    81.3570    81.6060    82.7963    83.0229    84.0941    84.0941    84.2956    83.6782    83.0229    82.5658    82.0933
alpha            6.4070     6.4238     6.4404     6.5198     6.5349     6.6063     6.6063     6.6197     6.5785     6.5349     6.5044     6.4729
util living area
                 0.9981     0.9952     0.9838     0.9326     0.7947     0.5883     0.4292     0.4793     0.7572     0.9652     0.9954     0.9986 (86)

MIT             20.1606    20.2892    20.5063    20.7730    20.9400    20.9929    20.9992    20.9984    20.9672    20.7322    20.3974    20.1389 (87)
Th 2            20.2049    20.2071    20.2094    20.2199    20.2219    20.2310    20.2310    20.2327    20.2275    20.2219    20.2179    20.2137 (88)
util rest of house
                 0.9975     0.9937     0.9786     0.9124     0.7467     0.5212     0.3547     0.4005     0.6894     0.9505     0.9936     0.9982 (89)
MIT 2           19.0738    19.2630    19.5785    19.9578    20.1657    20.2264    20.2307    20.2321    20.2025    19.9112    19.4297    19.0489 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3516 (91)
MIT             19.4560    19.6239    19.9047    20.2445    20.4380    20.4959    20.5010    20.5016    20.4714    20.1999    19.7700    19.4322 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT    19.4560    19.6239    19.9047    20.2445    20.4380    20.4959    20.5010    20.5016    20.4714    20.1999    19.7700    19.4322 (93)


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8. Space heating requirement
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                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9967     0.9923     0.9761     0.9131     0.7607     0.5446     0.3809     0.4283     0.7118     0.9500     0.9923     0.9975 (94)
Useful gains   427.0122   480.6145   535.3697   564.1196   503.0913   353.4394   235.6518   246.9172   371.5677   433.2118   411.4058   406.0006 (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
               950.3099   920.3510   835.3384   696.7856   535.2299   356.5444   235.9021   247.4405   387.2096   588.0247   780.3718   943.5857 (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
               389.3335   295.5029   223.1767    95.5195    23.9111     0.0000     0.0000     0.0000     0.0000   115.1808   265.6555   399.9633 (98)
Space heating                                                                                                                    1808.2434 (98)
Space heating per m2                                                                                                  (98) / (4) =     24.6927 (99)


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8c. Space cooling requirement
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Not applicable


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9a. Energy requirements - Individual heating systems, including micro-CHP
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Fraction of space heat from secondary/supplementary system (Table 11)                                                           0.0000 (201)
Fraction of space heat from main system(s)                                                                                       1.0000 (202)
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1936.0207	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	389.3335	295.5029	223.1767	95.5195	23.9111	0.0000	0.0000	0.0000	0.0000	115.1808	265.6555	399.9633	(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)	416.8453	316.3843	238.9472	102.2693	25.6008	0.0000	0.0000	0.0000	0.0000	123.3199	284.4278	428.2262	(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	195.8291	171.0618	177.9787	157.8582	152.8346	134.6081	128.9649	143.7656	145.3533	165.5137	176.6826	191.2303	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.7485	86.4149	85.6220	83.8309	81.5324	80.3000	80.3000	80.3000	80.3000	84.1583	86.0756	86.8659	(217)
Fuel for water heating, kWh/month	225.7435	197.9540	207.8657	188.3056	187.4527	167.6316	160.6038	179.0356	181.0129	196.6695	205.2645	220.1444	(219)
Water heating fuel used												2317.6836	(219)

Annual totals kWh/year		
Space heating fuel - main system	1936.0207	(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)	346.0160	(232)
Total delivered energy for all uses	4674.7204	(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	1936.0207	0.2160	418.1805	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2317.6836	0.2160	500.6197	(264)
Space and water heating			918.8001	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	346.0160	0.5190	179.5823	(268)
Total CO2, kg/m2/year			1137.3075	(272)
Emissions per m2 for space and water heating			12.5468	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4523	(272b)
Emissions per m2 for pumps and fans			0.5315	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5468 * 1.00) + 2.4523 + 0.5315, rounded to 2 d.p.			15.5300	(273)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1707	(8)
Pressure test		Yes	
Measured/design AP50		3.5100	
Infiltration rate		0.3462	(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) =	0.2683	(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	0.3421	0.3354	0.3287	0.2951	0.2884	0.2549	0.2549	0.2482	0.2683	0.2884	0.3018	0.3153	(22b)
Effective ac	0.5585	0.5562	0.5540	0.5436	0.5416	0.5325	0.5325	0.5308	0.5360	0.5416	0.5456	0.5497	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1600	3.5024			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1584	3.1240			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.3757			(33)
Party Wall 1			17.7000	0.0000	0.0000			(32)
Party Wall 2			17.7000	0.0000	0.0000			(32)
Party Floor 1			72.3300					(32d)
Party Ceilings 1			73.2300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0980	(36)
Total fabric heat loss (33) + (36) =	28.4737	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.3926	32.2608	32.1317	31.5250	31.4115	30.8831	30.8831	30.7852	31.0866	31.4115	31.6411	31.8812	(38)
Heat transfer coeff	60.8663	60.7345	60.6054	59.9987	59.8852	59.3568	59.3568	59.2589	59.5603	59.8852	60.1148	60.3549	(39)
Average = Sum(39)m / 12 =												59.9981	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8312	0.8294	0.8276	0.8193	0.8178	0.8106	0.8106	0.8092	0.8133	0.8178	0.8209	0.8242	(40)
HLP (average)												0.8193	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(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													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.9712	27.0876	27.9520	24.3692	23.3828	20.1776	18.6975	21.4557	21.7119	25.3031	27.6204	29.9939	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	116.0960	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5929	17.4022	14.1524	10.7143	8.0091	6.7616	7.3061	9.4968	12.7466	16.1847	18.8899	20.1374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.7153	206.8396	201.4864	190.0901	175.7044	162.1838	153.1512	151.0269	156.3801	167.7764	182.1621	195.6827	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	34.6096	(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)													
	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	(71)
Water heating gains (Table 5)													
	41.6279	40.3089	37.5698	33.8461	31.4285	28.0244	25.1311	28.8383	30.1554	34.0096	38.3616	40.3144	(72)
Total internal gains													
	323.7649	322.3795	311.0375	292.4793	272.9708	254.7986	243.4172	247.1908	257.1109	275.7995	297.2425	313.9633	(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	
West	10.2200	19.6403	0.4500	0.0000	0.7700	69.5507	(80)

Solar gains	69.5507	136.0559	224.0647	326.7850	400.4873	409.9700	390.3082	335.2689	260.5965	161.4418	86.7215	57.1951	(83)
Total gains	393.3156	458.4354	535.1022	619.2643	673.4581	664.7686	633.7254	582.4597	517.7074	437.2413	383.9640	371.1584	(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	83.5506	83.7319	83.9103	84.7588	84.9195	85.6754	85.6754	85.8169	85.3827	84.9195	84.5951	84.2586	
alpha	6.5700	6.5821	6.5940	6.6506	6.6613	6.7117	6.7117	6.7211	6.6922	6.6613	6.6397	6.6172	
util living area													
	0.9988	0.9964	0.9848	0.9274	0.7743	0.5656	0.4115	0.4665	0.7518	0.9698	0.9969	0.9992	(86)
MIT	20.1509	20.2903	20.5207	20.7930	20.9516	20.9947	20.9995	20.9988	20.9703	20.7286	20.3822	20.1232	(87)
Th 2	20.2264	20.2280	20.2295	20.2366	20.2380	20.2442	20.2442	20.2454	20.2418	20.2380	20.2353	20.2324	(88)
util rest of house													
	0.9984	0.9952	0.9799	0.9063	0.7260	0.5014	0.3412	0.3908	0.6848	0.9567	0.9957	0.9989	(89)
MIT 2	19.4412	19.5814	19.8102	20.0743	20.2074	20.2419	20.2441	20.2450	20.2264	20.0211	19.6796	19.4186	(90)
Living area fraction									fLA = Living area / (4) =			0.3516	(91)
MIT	19.6908	19.8307	20.0600	20.3270	20.4691	20.5066	20.5097	20.5101	20.4880	20.2699	19.9267	19.6664	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6908	19.8307	20.0600	20.3270	20.4691	20.5066	20.5097	20.5101	20.4880	20.2699	19.9267	19.6664	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9944	0.9786	0.9091	0.7413	0.5240	0.3659	0.4175	0.7076	0.9574	0.9951	0.9987	(94)
Useful gains	392.5523	455.8768	523.6354	562.9684	499.2326	348.3199	231.8922	243.1533	366.3047	418.5940	382.0733	370.6580	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	936.7789	906.8071	821.8090	685.6075	525.1396	350.5977	232.0657	243.5578	380.4687	579.0832	771.0718	933.4716	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	404.9046	303.0252	221.8412	88.3001	19.2748	0.0000	0.0000	0.0000	0.0000	119.4040	280.0789	418.7333	(98)
Space heating												1855.5621	(98)
Space heating per m2											(98) / (4) =	25.3388	(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	557.9537	439.2401	450.3678	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9805	0.9932	0.9883	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	547.0716	436.2478	445.1115	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	863.8713	825.8765	767.5582	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	228.0958	289.8837	239.9003	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												757.8799	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction												fC = cooled area / (4) =	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)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	57.0240	72.4709	59.9751	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling													189.4700 (107)
Space cooling per m2													2.5873 (108)
Energy for space heating													25.3388 (99)
Energy for space cooling													2.5873 (108)
Total													27.9262 (109)
Dwelling Fabric Energy Efficiency (DFEE)													27.9 (109)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1707	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4207	(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) =	0.3260	(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	0.4157	0.4075	0.3994	0.3586	0.3505	0.3097	0.3097	0.3016	0.3260	0.3505	0.3668	0.3831	(22b)
Effective ac	0.5864	0.5830	0.5798	0.5643	0.5614	0.5480	0.5480	0.5455	0.5532	0.5614	0.5673	0.5734	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			10.2200	1.3258	13.5492			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1800	3.9402			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1800	3.5496			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1590			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5327	(36)
Total fabric heat loss					(33) + (36) =		28.6917	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.0103	33.8157	33.6250	32.7291	32.5615	31.7812	31.7812	31.6367	32.0817	32.5615	32.9005	33.2550	(38)
Heat transfer coeff	62.7020	62.5074	62.3167	61.4208	61.2532	60.4729	60.4729	60.3284	60.7735	61.2532	61.5923	61.9468	(39)
Average = Sum(39)m / 12 =												61.4200	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8562	0.8536	0.8510	0.8387	0.8364	0.8258	0.8258	0.8238	0.8299	0.8364	0.8411	0.8459	(40)
HLP (average)												0.8387	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(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)
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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Heat gains from water heating, kWh/month
                30.9712    27.0876    27.9520    24.3692    23.3828    20.1776    18.6975    21.4557    21.7119    25.3031    27.6204    29.9939 (65)


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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          116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960   116.0960 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                19.5929    17.4022    14.1524    10.7143     8.0091     6.7616     7.3061     9.4968    12.7466    16.1847    18.8899    20.1374 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               204.7153   206.8396   201.4864   190.0901   175.7044   162.1838   153.1512   151.0269   156.3801   167.7764   182.1621   195.6827 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096    34.6096 (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)
               -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768   -92.8768 (71)
Water heating gains (Table 5)
                41.6279    40.3089    37.5698    33.8461    31.4285    28.0244    25.1311    28.8383    30.1554    34.0096    38.3616    40.3144 (72)
Total internal gains
               323.7649   322.3795   311.0375   292.4793   272.9708   254.7986   243.4172   247.1908   257.1109   275.7995   297.2425   313.9633 (73)


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6. Solar gains
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[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
---------------------------------------------------------------------------------------------------------------
West                                     10.2200          19.6403          0.6300           0.7000        0.7700          61.3437 (80)
---------------------------------------------------------------------------------------------------------------

Solar gains     61.3437   120.0013   197.6251   288.2244   353.2298   361.5935   344.2518   295.7072   229.8461   142.3917    76.4884    50.4461 (83)
Total gains    385.1086   442.3808   508.6626   580.7037   626.2006   616.3922   587.6690   542.8980   486.9570   418.1911   373.7309   364.4094 (84)


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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            81.1045    81.3570    81.6060    82.7963    83.0229    84.0941    84.0941    84.2956    83.6782    83.0229    82.5658    82.0933
alpha           6.4070     6.4238     6.4404     6.5198     6.5349     6.6063     6.6063     6.6197     6.5785     6.5349     6.5044     6.4729
util living area
                0.9990     0.9971     0.9890     0.9481     0.8229     0.6168     0.4514     0.5082     0.7952     0.9771     0.9974     0.9993 (86)

MIT            20.1024    20.2337    20.4568    20.7381    20.9261    20.9907    20.9989    20.9978    20.9563    20.6893    20.3431    20.0814 (87)
Th 2           20.2049    20.2071    20.2094    20.2199    20.2219    20.2310    20.2310    20.2327    20.2275    20.2219    20.2179    20.2137 (88)
util rest of house
                0.9986     0.9962     0.9853     0.9313     0.7770     0.5475     0.3733     0.4250     0.7293     0.9666     0.9964     0.9990 (89)
MIT 2          19.3747    19.5075    19.7304    20.0099    20.1737    20.2269    20.2308    20.2321    20.2040    19.9700    19.6260    19.3612 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.3516 (91)
MIT            19.6306    19.7628    19.9858    20.2660    20.4382    20.4954    20.5009    20.5013    20.4685    20.2230    19.8781    19.6144 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT   19.6306    19.7628    19.9858    20.2660    20.4382    20.4954    20.5009    20.5013    20.4685    20.2230    19.8781    19.6144 (93)


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8. Space heating requirement
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                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9983     0.9955     0.9841     0.9325     0.7906     0.5717     0.4008     0.4544     0.7511     0.9667     0.9958     0.9988 (94)
Useful gains  384.4501   440.4004   500.5553   541.4821   495.0477   352.4128   235.5570   246.6843   365.7765   404.2449   372.1795   363.9677 (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
               961.2586   929.0375   840.3928   698.1071   535.2447   356.5144   235.8970   247.4277   387.0360   589.4371   787.0350   954.8752 (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
               429.1455   328.3642   252.8391   112.7700    29.9066     0.0000     0.0000     0.0000     0.0000   137.7830   298.6960   439.6352 (98)
Space heating                                                                                                                   2029.1396 (98)
Space heating per m2                                                                                                 (98) / (4) =     27.7091 (99)


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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   568.4453   447.4995   458.4959     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation     0.0000     0.0000     0.0000     0.0000     0.0000     0.9687     0.9884     0.9813     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss     0.0000     0.0000     0.0000     0.0000     0.0000   550.6420   442.2918   449.9029     0.0000     0.0000     0.0000     0.0000 (102)
Total gains     0.0000     0.0000     0.0000     0.0000     0.0000   807.3274   772.0444   721.3172     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   184.8135   245.3359   201.9322     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                   632.0817 (104)
Cooled fraction                                                                                      fC = cooled area / (4) =      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)
Space cooling kWh
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	46.2034	61.3340	50.4831	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												158.0204	(107)
Space cooling per m2												2.1579	(108)
Energy for space heating												27.7091	(99)
Energy for space cooling												2.1579	(108)
Total												29.8670	(109)
Target Fabric Energy Efficiency (TFEE)												34.3	(109)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5100	
Infiltration rate		0.1755	(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) =	0.1360	(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	0.1428	0.1360	0.1360	0.1258	0.1258	0.1122	0.1156	0.1088	0.1122	0.1190	0.1190	0.1292	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1600	3.5024			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1584	3.1240			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.3757			(33)
Party Wall 1			17.7000	0.0000	0.0000			(32)
Party Wall 2			17.7000	0.0000	0.0000			(32)
Party Floor 1			72.3300					(32d)
Party Ceilings 1			73.2300					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0980	(36)
Total fabric heat loss (33) + (36) =	28.4737	(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	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	(38)
Heat transfer coeff	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	(39)
Average = Sum(39)m / 12 =												57.4728	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	(40)
HLP (average)												0.7848	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.8620	19.1206	19.7308	17.2018	16.5055	14.2430	13.1982	15.1452	15.3261	17.8610	19.4967	21.1722	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1003	12.7150	14.0443	13.5538	13.9784	13.4960	13.9264	13.9601	13.5275	14.0170	13.6082	14.0895	(61)
Total heat required for water heating calculated for each month	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.7708	(64)
RHI water heating demand												1571	(64)
Heat gains from water heating, kWh/month	51.9858	45.5628	47.2477	41.5191	40.0818	34.9460	32.7377	37.0618	37.3546	43.0962	46.6198	50.4540	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.9821	43.5055	35.3811	26.7857	20.0227	16.9040	18.2653	23.7420	31.8664	40.4617	47.2248	50.3435	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5452	308.7158	300.7260	283.7166	262.2454	242.0654	228.5839	225.4133	233.4031	250.4125	271.8838	292.0638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	(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)	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	(71)
Water heating gains (Table 5)	69.8734	67.8019	63.5049	57.6654	53.8734	48.5361	44.0023	49.8143	51.8814	57.9250	64.7497	67.8146	(72)
Total internal gains	525.0927	520.7150	500.3038	468.8596	436.8333	408.1973	391.5434	399.6614	417.8428	449.4911	484.5502	510.9137	(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	
West	10.2200	22.3313	0.4500	0.0000	0.7700	79.0803	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	79.0803	139.1533	225.9604	338.6498	403.5155	441.7215	416.1196	366.0865	284.5456	176.2051	101.0154	64.4008	(83)
Total gains	604.1730	659.8683	726.2642	807.5094	840.3488	849.9189	807.6629	765.7479	702.3884	625.6962	585.5656	575.3145	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	
alpha	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	
util living area	0.9797	0.9628	0.9031	0.7514	0.5432	0.3380	0.2206	0.2402	0.4731	0.8011	0.9529	0.9844	(86)
MIT	20.5578	20.6568	20.8272	20.9571	20.9955	20.9999	21.0000	21.0000	20.9986	20.9464	20.7401	20.5226	(87)
Th 2	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	(88)
util rest of house	0.9741	0.9531	0.8811	0.7117	0.4950	0.2885	0.1684	0.1851	0.4140	0.7557	0.9388	0.9799	(89)
MIT 2	19.8775	19.9725	20.1297	20.2375	20.2642	20.2665	20.2665	20.2665	20.2660	20.2319	20.0532	19.8435	(90)
Living area fraction									fLA = Living area / (4) =			0.3516	(91)
MIT	20.1167	20.2131	20.3750	20.4906	20.5213	20.5243	20.5244	20.5244	20.5236	20.4831	20.2947	20.0823	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.9667	20.0631	20.2250	20.3406	20.3713	20.3743	20.3744	20.3744	20.3736	20.3331	20.1447	19.9323	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9713	0.9500	0.8798	0.7159	0.5019	0.2958	0.1761	0.1932	0.4227	0.7601	0.9361	0.9774	(94)
Useful gains	586.8534	626.8779	638.9430	578.0695	421.7794	251.3660	142.2112	147.9577	296.8838	475.6025	548.1394	562.3207	(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	854.4310	831.2371	737.0890	600.0489	423.6510	251.4057	142.2119	147.9591	297.3400	501.9159	697.9914	852.4524	(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	199.0777	137.3294	73.0206	15.8252	1.3925	0.0000	0.0000	0.0000	0.0000	19.5772	107.8934	215.8580	(98)
Space heating												769.9740	(98)
RHI space heating demand												770	(98)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5100	
Infiltration rate		0.1755	(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) =	0.1360	(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	0.1734	0.1700	0.1666	0.1496	0.1462	0.1292	0.1292	0.1258	0.1360	0.1462	0.1530	0.1598	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1600	3.5024			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1584	3.1240			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.3757			(33)
Party Wall 1			17.7000	0.0000	0.0000			(32)
Party Wall 2			17.7000	0.0000	0.0000			(32)
Party Floor 1			72.3300					(32d)
Party Ceilings 1			73.2300					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0980	(36)
Total fabric heat loss						(33) + (36) =	28.4737	(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	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	(38)
Heat transfer coeff	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	(39)
Average = Sum(39)m / 12 =												57.4728	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	(40)
HLP (average)												0.7848	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.8620	19.1206	19.7308	17.2018	16.5055	14.2430	13.1982	15.1452	15.3261	17.8610	19.4967	21.1722	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1003	12.7150	14.0443	13.5538	13.9784	13.4960	13.9264	13.9601	13.5275	14.0170	13.6082	14.0895	(61)
Total heat required for water heating calculated for each month	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.7708	(64)
Heat gains from water heating, kWh/month	51.9858	45.5628	47.2477	41.5191	40.0818	34.9460	32.7377	37.0618	37.3546	43.0962	46.6198	50.4540	(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	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.9821	43.5055	35.3811	26.7857	20.0227	16.9040	18.2653	23.7420	31.8664	40.4617	47.2248	50.3435	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5452	308.7158	300.7260	283.7166	262.2454	242.0654	228.5839	225.4133	233.4031	250.4125	271.8838	292.0638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	(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)	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	(71)
Water heating gains (Table 5)	69.8734	67.8019	63.5049	57.6654	53.8734	48.5361	44.0023	49.8143	51.8814	57.9250	64.7497	67.8146	(72)
Total internal gains	525.0927	520.7150	500.3038	468.8596	436.8333	408.1973	391.5434	399.6614	417.8428	449.4911	484.5502	510.9137	(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	
West	10.2200	19.6403	0.4500	0.0000	0.7700	69.5507	(80)

Solar gains	69.5507	136.0559	224.0647	326.7850	400.4873	409.9700	390.3082	335.2689	260.5965	161.4418	86.7215	57.1951	(83)
Total gains	594.6434	656.7709	724.3685	795.6446	837.3206	818.1673	781.8515	734.9303	678.4393	610.9329	571.2717	568.1088	(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	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	
alpha	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	
util living area	0.9857	0.9708	0.9257	0.8076	0.6276	0.4486	0.3233	0.3595	0.5785	0.8636	0.9697	0.9892	(86)
MIT	20.4866	20.6047	20.7763	20.9274	20.9876	20.9989	20.9999	20.9998	20.9943	20.9037	20.6635	20.4456	(87)
Th 2	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	(88)
util rest of house	0.9818	0.9632	0.9085	0.7733	0.5817	0.3976	0.2695	0.3023	0.5195	0.8283	0.9605	0.9862	(89)
MIT 2	19.8079	19.9223	20.0836	20.2143	20.2592	20.2660	20.2665	20.2664	20.2639	20.1985	19.9807	19.7676	(90)
Living area fraction									fLA = Living area / (4) =			0.3516	(91)
MIT	20.0465	20.1623	20.3272	20.4650	20.5154	20.5237	20.5244	20.5243	20.5207	20.4464	20.2208	20.0060	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.8965	20.0123	20.1772	20.3150	20.3654	20.3737	20.3744	20.3743	20.3707	20.2964	20.0708	19.8560	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9794	0.9602	0.9061	0.7757	0.5880	0.4051	0.2774	0.3107	0.5280	0.8299	0.9576	0.9841	(94)
Useful gains	582.3665	630.6067	656.3635	617.1660	492.3285	331.4418	216.9012	228.3655	358.2312	506.9939	547.0266	559.0960	(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	896.3763	868.5436	786.0660	656.0543	498.0233	331.8322	216.9238	228.4151	360.3956	557.2819	745.4681	899.7956	(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	233.6233	159.8936	96.4986	27.9996	4.2369	0.0000	0.0000	0.0000	0.0000	37.4143	142.8779	253.4805	(98)
Space heating												956.0249	(98)
Space heating per m2											(98) / (4) =	13.0551	(99)

8c. Space cooling requirement

Not applicable

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	1056.3811	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	233.6233	159.8936	96.4986	27.9996	4.2369	0.0000	0.0000	0.0000	0.0000	37.4143	142.8779	253.4805	(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)													
	258.1473	176.6780	106.6283	30.9388	4.6817	0.0000	0.0000	0.0000	0.0000	41.3418	157.8762	280.0890	(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													
	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.1721	88.9764	88.5481	87.8567	87.4021	87.3000	87.3000	87.3000	87.3000	87.9827	88.8672	89.2573	(217)
Fuel for water heating, kWh/month													
	179.2567	157.5541	164.4111	145.9562	141.8904	124.2262	116.7407	131.6471	132.5329	151.2691	161.5740	173.9211	(219)
Water heating fuel used												1780.9795	(219)

Annual totals kWh/year		
Space heating fuel - main system	1056.3811	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	39.4528	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.4528	(231)
Electricity for lighting (calculated in Appendix L)	346.0160	(232)
Total delivered energy for all uses	3297.8294	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1056.3811	3.4800	36.7621	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1780.9795	3.4800	61.9781	(247)
Mechanical ventilation fans	39.4528	13.1900	5.2038	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	346.0160	13.1900	45.6395	(250)
Additional standing charges			120.0000	(251)
Total energy cost			279.4760	(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] =	0.9928	(257)
SAP value		86.1503	
SAP rating (Section 12)		86	(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	1056.3811	0.2160	228.1783	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1780.9795	0.2160	384.6916	(264)
Space and water heating			612.8699	(265)
Pumps and fans	114.4528	0.5190	59.4010	(267)
Energy for lighting	346.0160	0.5190	179.5823	(268)
Total kg/year			851.8532	(272)
CO2 emissions per m2			11.6300	(273)
EI value			90.3452	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8811 = 3.950, stars = 4
Water heating environmental impact	0.216 / 0.8811 = 0.2452, stars = 4

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.2300 (1b)	x	2.4000 (2b)	=	175.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.7520	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							0 * 10 =		0.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			3.5100	
Infiltration rate			0.1755	(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) =		0.1360	(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	0.1428	0.1360	0.1360	0.1258	0.1258	0.1122	0.1156	0.1088	0.1122	0.1190	0.1190	0.1292	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			10.2200	1.2357	12.6293			(27)
WT-E-03	32.1100	10.2200	21.8900	0.1600	3.5024			(29a)
WT-I-02	21.8400	2.1200	19.7200	0.1584	3.1240			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.3757			(33)
Party Wall 1			17.7000	0.0000	0.0000			(32)
Party Wall 2			17.7000	0.0000	0.0000			(32)
Party Floor 1			72.3300					(32d)
Party Ceilings 1			73.2300					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0980	(36)
Total fabric heat loss						(33) + (36) =	28.4737	(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	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	28.9991	(38)
Heat transfer coeff	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	57.4728	(39)
Average = Sum(39)m / 12 =												57.4728	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	0.7848	(40)
HLP (average)												0.7848	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3219	(42)
Average daily hot water use (litres/day)	89.3456	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.2802	94.7063	91.1325	87.5587	83.9849	80.4110	80.4110	83.9849	87.5587	91.1325	94.7063	98.2802	(44)
Energy conte	145.7467	127.4710	131.5386	114.6785	110.0368	94.9534	87.9883	100.9678	102.1737	119.0736	129.9781	141.1478	(45)
Energy content (annual)										Total = Sum(45)m =		1405.7543	(45)

Distribution loss (46)m = 0.15 x (45)m

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

	21.8620	19.1206	19.7308	17.2018	16.5055	14.2430	13.1982	15.1452	15.3261	17.8610	19.4967	21.1722	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1003	12.7150	14.0443	13.5538	13.9784	13.4960	13.9264	13.9601	13.5275	14.0170	13.6082	14.0895	(61)
Total heat required for water heating calculated for each month	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.7708	(64)
Heat gains from water heating, kWh/month	51.9858	45.5628	47.2477	41.5191	40.0818	34.9460	32.7377	37.0618	37.3546	43.0962	46.6198	50.4540	(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	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	139.3152	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.9821	43.5055	35.3811	26.7857	20.0227	16.9040	18.2653	23.7420	31.8664	40.4617	47.2248	50.3435	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5452	308.7158	300.7260	283.7166	262.2454	242.0654	228.5839	225.4133	233.4031	250.4125	271.8838	292.0638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	51.2534	(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)	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	-92.8768	(71)
Water heating gains (Table 5)	69.8734	67.8019	63.5049	57.6654	53.8734	48.5361	44.0023	49.8143	51.8814	57.9250	64.7497	67.8146	(72)
Total internal gains	525.0927	520.7150	500.3038	468.8596	436.8333	408.1973	391.5434	399.6614	417.8428	449.4911	484.5502	510.9137	(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	
West	10.2200	22.3313	0.4500	0.0000	0.7700	79.0803	(80)

Solar gains	79.0803	139.1533	225.9604	338.6498	403.5155	441.7215	416.1196	366.0865	284.5456	176.2051	101.0154	64.4008	(83)
Total gains	604.1730	659.8683	726.2642	807.5094	840.3488	849.9189	807.6629	765.7479	702.3884	625.6962	585.5656	575.3145	(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	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	88.4839	
alpha	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	6.8989	
util living area	0.9797	0.9628	0.9031	0.7514	0.5432	0.3380	0.2206	0.2402	0.4731	0.8011	0.9529	0.9844	(86)
MIT	20.5578	20.6568	20.8272	20.9571	20.9955	20.9999	21.0000	21.0000	20.9986	20.9464	20.7401	20.5226	(87)
Th 2	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	20.2665	(88)
util rest of house	0.9741	0.9531	0.8811	0.7117	0.4950	0.2885	0.1684	0.1851	0.4140	0.7557	0.9388	0.9799	(89)
MIT 2	19.8775	19.9725	20.1297	20.2375	20.2642	20.2665	20.2665	20.2665	20.2660	20.2319	20.0532	19.8435	(90)
Living area fraction									fLA = Living area / (4) =			0.3516	(91)
MIT	20.1167	20.2131	20.3750	20.4906	20.5213	20.5243	20.5244	20.5244	20.5236	20.4831	20.2947	20.0823	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.9667	20.0631	20.2250	20.3406	20.3713	20.3743	20.3744	20.3744	20.3736	20.3331	20.1447	19.9323	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9713	0.9500	0.8798	0.7159	0.5019	0.2958	0.1761	0.1932	0.4227	0.7601	0.9361	0.9774	(94)
Useful gains	586.8534	626.8779	638.9430	578.0695	421.7794	251.3660	142.2112	147.9577	296.8838	475.6025	548.1394	562.3207	(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	854.4310	831.2371	737.0890	600.0489	423.6510	251.4057	142.2119	147.9591	297.3400	501.9159	697.9914	852.4524	(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	199.0777	137.3294	73.0206	15.8252	1.3925	0.0000	0.0000	0.0000	0.0000	19.5772	107.8934	215.8580	(98)
Space heating												769.9740	(98)
Space heating per m2										(98) / (4) =		10.5145	(99)

8c. Space cooling requirement

Not applicable

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	850.8000	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	199.0777	137.3294	73.0206	15.8252	1.3925	0.0000	0.0000	0.0000	0.0000	19.5772	107.8934	215.8580	(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)													
	219.9754	151.7451	80.6858	17.4864	1.5387	0.0000	0.0000	0.0000	0.0000	21.6323	119.2193	238.5171	(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													
	159.8470	140.1860	145.5829	128.2323	124.0151	108.4494	101.9146	114.9279	115.7012	133.0906	143.5864	155.2373	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.0464	88.8547	88.3434	87.6404	87.3343	87.3000	87.3000	87.3000	87.3000	87.6976	88.6448	89.1333	(217)
Fuel for water heating, kWh/month													
	179.5098	157.7698	164.7919	146.3164	142.0005	124.2262	116.7407	131.6471	132.5329	151.7607	161.9795	174.1632	(219)
Water heating fuel used												1783.4388	(219)
Annual totals kWh/year													
Space heating fuel - main system												850.8000	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)

mechanical ventilation fans (SFP = 0.1840)	39.4528	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.4528	(231)
Electricity for lighting (calculated in Appendix L)	346.0160	(232)
Total delivered energy for all uses	3094.7077	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	850.8000	3.7400	31.8199	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1783.4388	3.7400	66.7006	(247)
Mechanical ventilation fans	39.4528	19.1200	7.5434	(249)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Energy for lighting	346.0160	19.1200	66.1583	(250)
Additional standing charges			94.0000	(251)
Total energy cost			280.5622	(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	850.8000	0.2160	183.7728	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.4388	0.2160	385.2228	(264)
Space and water heating			568.9956	(265)
Pumps and fans	114.4528	0.5190	59.4010	(267)
Energy for lighting	346.0160	0.5190	179.5823	(268)
Total kg/year			807.9789	(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	850.8000	1.2200	1037.9760	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.4388	1.2200	2175.7954	(264)
Space and water heating			3213.7714	(265)
Pumps and fans	114.4528	3.0700	351.3701	(267)
Energy for lighting	346.0160	3.0700	1062.2692	(268)
Primary energy kWh/year			4627.4107	(272)
Primary energy kWh/m2/year			63.1901	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 90

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)			

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 86
Potential environmental impact rating: B 90

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

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£88	£88	£0
Mains gas	£193	£193	£0
Space heating	£148	£148	£0
Water heating	£67	£67	£0
Lighting	£66	£66	£0
Total cost of fuels	£281	£281	£0
Total cost of uses	£281	£281	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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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	East
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	347.99	(P1)
Transmission heat loss coefficient	28.47	(37)
Summer heat loss coefficient	376.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
West	1.000	0.90	1.000	0.900	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
West	10.2200	117.5071	0.4500	0.0000	0.9000	486.3735
total:						486.3735

	Jun	Jul	Aug	
Solar gains	516	486	428	(P4)
Internal gains	405	389	397	
Total summer gains	921	875	825	(P5)
Summer gain/loss ratio	2.45	2.32	2.19	(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	18.70	20.47	20.24	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant