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

Property Reference	SECPMW026h_134_As_Built	**Issued on Date**	03/12/2021
Assessment Reference	001	**Prop Type Ref**	TFF
Property			

SAP Rating	84 B	**DER**	17.39	**TER**	18.21
Environmental	87 B	**% DER<TER**	4.48		
CO_2 Emissions (t/year)	1.03	**DFEE**	44.06	**TFEE**	47.81
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.84		

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 4.14r19

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

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DWELLING AS BUILT

Top-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) 18.21 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.39 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)47.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.33 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

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

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3 Air permeability
Air permeability at 50 pascals: 3.70 (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
Door U-value 1.00 W/m²K
Air permeability 3.7 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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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		3.7000	
Infiltration rate		0.1850	(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) =	0.1434	(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	0.1828	0.1792	0.1756	0.1577	0.1541	0.1362	0.1362	0.1326	0.1434	0.1541	0.1613	0.1685	(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-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Flat Roof	72.6200		72.6200	0.1500	10.8930			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0180			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6856	(36)
Total fabric heat loss						(33) + (36) =	48.7036	(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	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	(39)
Average = Sum(39)m / 12 =												77.4611	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	(40)
HLP (average)												1.0667	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(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	14.0978	12.7129	14.0421	13.5520	13.9767	13.4947	13.9251	13.9586	13.5259	14.0151	13.6061	14.0870	(61)
Total heat required for water heating calculated for each month													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(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													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
								Total per year (kWh/year) = Sum(64)m =				1565.5522	(64)
Heat gains from water heating, kWh/month													
	51.8061	45.4056	47.0855	41.3777	39.9462	34.8290	32.6292	36.9374	37.2287	42.9494	46.4595	50.2799	(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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	69.6318	67.5679	63.2869	57.4690	53.6911	48.3736	43.8565	49.6470	51.7065	57.7277	64.5271	67.5806	(72)
Total internal gains													
	353.0104	350.8845	338.0645	317.5185	296.7699	276.7863	263.8375	269.6899	280.2884	301.0377	324.8078	342.5274	(73)

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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	422.5611	486.9404	562.1292	644.3035	697.2572	686.7563	654.1457	604.9589	540.8850	462.4795	411.5294	399.7225	(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	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	
alpha	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	
util living area													
	0.9983	0.9960	0.9875	0.9534	0.8557	0.6815	0.5132	0.5742	0.8372	0.9773	0.9964	0.9987	(86)
MIT	19.8552	19.9992	20.2540	20.5759	20.8375	20.9636	20.9933	20.9882	20.8928	20.5357	20.1245	19.8153	(87)
Th 2	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	(88)
util rest of house													
	0.9977	0.9946	0.9830	0.9366	0.8078	0.5942	0.4040	0.4604	0.7662	0.9662	0.9949	0.9983	(89)
MIT 2	18.9819	19.1253	19.3777	19.6887	19.9206	20.0118	20.0265	20.0248	19.9693	19.6559	19.2507	18.9421	(90)
Living area fraction										fLA = Living area / (4) =		0.3546	(91)
MIT	19.2916	19.4352	19.6884	20.0033	20.2457	20.3493	20.3693	20.3664	20.2968	19.9678	19.5606	19.2517	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1416	19.2852	19.5384	19.8533	20.0957	20.1993	20.2193	20.2164	20.1468	19.8178	19.4106	19.1017	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9932	0.9801	0.9330	0.8115	0.6104	0.4259	0.4832	0.7760	0.9630	0.9936	0.9977	(94)
Useful gains	421.2835	483.6267	550.9502	601.1121	565.8498	419.2096	278.6100	292.2879	419.7454	445.3680	408.8857	398.8144	(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													
	1149.6445	1114.2907	1009.9700	848.4513	650.3441	433.7302	280.3543	295.6249	468.3901	714.0243	953.5907	1154.3063	(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													
	541.9006	423.8062	341.5107	178.0842	62.8637	0.0000	0.0000	0.0000	0.0000	199.8803	392.1876	562.0859	(98)
Space heating												2702.3193	(98)
Space heating per m2											(98) / (4) =	37.2118	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2985.9882	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	541.9006	423.8062	341.5107	178.0842	62.8637	0.0000	0.0000	0.0000	0.0000	199.8803	392.1876	562.0859	(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)	598.7852	468.2942	377.3599	196.7782	69.4627	0.0000	0.0000	0.0000	0.0000	220.8622	433.3565	621.0894	(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	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7526	89.6850	89.5216	89.1349	88.3532	87.3000	87.3000	87.3000	87.3000	89.1958	89.6218	89.7896	(217)
Fuel for water heating, kWh/month	177.4943	155.7816	162.0778	143.3857	139.9007	123.8226	116.3667	131.2179	132.0985	148.7162	159.6752	172.3063	(219)
Water heating fuel used												1762.8434	(219)

Annual totals kWh/year

Space heating fuel - main system	2985.9882	(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)	39.1242	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1242	(231)
Electricity for lighting (calculated in Appendix L)	343.0552	(232)
Total delivered energy for all uses	5206.0110	(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	2985.9882	0.2160	644.9735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1762.8434	0.2160	380.7742	(264)
Space and water heating			1025.7476	(265)
Pumps and fans	114.1242	0.5190	59.2304	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total CO2, kg/year			1263.0237	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.3900	(273)

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

DER		17.3900	ZC1
Total Floor Area	TFA	72.6200	
Assumed number of occupants	N	2.3080	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5920	ZC2
CO2 emissions from cooking, equation (L16)		2.4014	ZC3
Total CO2 emissions		36.3834	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		36.3834	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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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) =	0.1721	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4221	(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) =	0.3271	(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	0.4171	0.4089	0.4008	0.3599	0.3517	0.3108	0.3108	0.3026	0.3271	0.3517	0.3680	0.3844	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739	(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-02	28.3400	10.2200	18.1200	0.1800	3.2616			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.1800	4.2282			(29a)
Flat Roof	72.6200		72.6200	0.1300	9.4406			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5996			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6063	(36)
Total fabric heat loss						(33) + (36) =	43.2059	(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	33.7609	33.5666	33.3762	32.4817	32.3143	31.5353	31.5353	31.3910	31.8354	32.3143	32.6529	33.0069	(38)
Heat transfer coeff	76.9669	76.7726	76.5821	75.6876	75.5203	74.7412	74.7412	74.5969	75.0413	75.5203	75.8588	76.2128	(39)
Average = Sum(39)m / 12 =												75.6868	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0599	1.0572	1.0546	1.0422	1.0399	1.0292	1.0292	1.0272	1.0333	1.0399	1.0446	1.0495	(40)
HLP (average)												1.0422	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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Combi loss	49.8974	43.4297	46.2685	43.0200	42.6396	39.5082	40.8251	42.6396	43.0200	46.2685	46.5319	49.8974	(61)
Total heat required for water heating calculated for each month													
	195.1053	170.4295	177.3209	157.2747	152.2696	134.1106	128.4882	143.2342	144.8161	164.9019	176.0296	190.5235	(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													
	195.1053	170.4295	177.3209	157.2747	152.2696	134.1106	128.4882	143.2342	144.8161	164.9019	176.0296	190.5235	(64)
Total per year (kWh/year) = Sum(64)m =												1934.5041	(64)
Heat gains from water heating, kWh/month													
	60.7560	53.0849	55.1420	48.7447	47.1119	41.3323	39.3542	44.1076	44.6022	51.0127	54.6910	59.2325	(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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	81.6613	78.9953	74.1156	67.7009	63.3224	57.4060	52.8955	59.2844	61.9475	68.5655	75.9597	79.6136	(72)
Total internal gains													
	365.0398	362.3119	348.8932	327.7505	306.4013	285.8188	272.8765	279.3274	290.5295	311.8755	336.2404	354.5604	(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	0.6300	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	426.3835	482.3132	546.5183	615.9749	659.6310	647.4123	617.1283	575.0346	520.3756	454.2672	412.7288	405.0065	(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	65.5224	65.6882	65.8516	66.6298	66.7775	67.4736	67.4736	67.6041	67.2037	66.7775	66.4795	66.1707	
alpha	5.3682	5.3792	5.3901	5.4420	5.4518	5.4982	5.4982	5.5069	5.4802	5.4518	5.4320	5.4114	
util living area													
	0.9982	0.9961	0.9888	0.9590	0.8702	0.6964	0.5249	0.5822	0.8436	0.9780	0.9963	0.9987	(86)
MIT	19.8696	20.0060	20.2497	20.5711	20.8307	20.9636	20.9935	20.9890	20.8959	20.5498	20.1518	19.8461	(87)
Th 2	20.0338	20.0360	20.0381	20.0483	20.0502	20.0591	20.0591	20.0607	20.0556	20.0502	20.0463	20.0423	(88)
util rest of house													
	0.9976	0.9948	0.9848	0.9439	0.8254	0.6109	0.4169	0.4707	0.7749	0.9673	0.9948	0.9982	(89)
MIT 2	18.5208	18.7215	19.0770	19.5414	19.8836	20.0348	20.0566	20.0561	19.9711	19.5200	18.9426	18.4927	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	18.9991	19.1770	19.4928	19.9065	20.2194	20.3641	20.3888	20.3869	20.2990	19.8852	19.3714	18.9726	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9991	19.1770	19.4928	19.9065	20.2194	20.3641	20.3888	20.3869	20.2990	19.8852	19.3714	18.9726	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9932	0.9818	0.9412	0.8343	0.6399	0.4554	0.5105	0.7946	0.9648	0.9933	0.9975	(94)
Useful gains	424.9702	479.0319	536.5544	579.7480	550.3179	414.2938	281.0534	293.5505	413.5011	438.2941	409.9439	403.9793	(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													
	1131.3426	1096.0808	995.0183	833.0570	643.3909	430.8181	283.1816	297.4074	465.1798	701.2188	930.8911	1125.8616	(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													
	525.5411	414.6568	341.0972	182.3824	69.2463	0.0000	0.0000	0.0000	0.0000	195.6159	375.0820	537.0804	(98)
Space heating												2640.7021	(98)
Space heating per m2											(98) / (4) =	36.3633	(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)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2827.3042	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	525.5411	414.6568	341.0972	182.3824	69.2463	0.0000	0.0000	0.0000	0.0000	195.6159	375.0820	537.0804	(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)	562.6778	443.9581	365.2004	195.2703	74.1395	0.0000	0.0000	0.0000	0.0000	209.4389	401.5867	575.0326	(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	195.1053	170.4295	177.3209	157.2747	152.2696	134.1106	128.4882	143.2342	144.8161	164.9019	176.0296	190.5235	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4230	87.2050	86.6713	85.4248	83.2060	80.3000	80.3000	80.3000	80.3000	85.4821	86.9085	87.5176	(217)
Fuel for water heating, kWh/month	223.1739	195.4355	204.5901	184.1089	183.0031	167.0120	160.0102	178.3738	180.3438	192.9082	202.5459	217.6974	(219)
Water heating fuel used												2289.2027	(219)

Annual totals kWh/year		
Space heating fuel - main system	2827.3042	(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)	343.0552	(232)
Total delivered energy for all uses	5534.5621	(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	2827.3042	0.2160	610.6977	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2289.2027	0.2160	494.4678	(264)
Space and water heating			1105.1655	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total CO2, kg/m2/year			1322.1361	(272)
Emissions per m2 for space and water heating			15.2185	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4517	(272b)
Emissions per m2 for pumps and fans			0.5360	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2185 * 1.00) + 2.4517 + 0.5360, rounded to 2 d.p.			18.2100	(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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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) =	0.1721	(8)
Pressure test		Yes	
Measured/design AP50		3.7000	
Infiltration rate		0.3571	(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) =	0.2768	(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	0.3529	0.3460	0.3390	0.3045	0.2975	0.2629	0.2629	0.2560	0.2768	0.2975	0.3114	0.3252	(22b)
Effective ac	0.5623	0.5598	0.5575	0.5463	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(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-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Flat Roof	72.6200		72.6200	0.1500	10.8930			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0180			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6856	(36)
Total fabric heat loss (33) + (36) =	48.7036	(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	32.3387	32.1996	32.0633	31.4231	31.3033	30.7457	30.7457	30.6424	30.9605	31.3033	31.5456	31.7990	(38)
Heat transfer coeff	81.0423	80.9032	80.7669	80.1267	80.0069	79.4493	79.4493	79.3460	79.6641	80.0069	80.2492	80.5026	(39)
Average = Sum(39)m / 12 =												80.1261	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1160	1.1141	1.1122	1.1034	1.1017	1.0940	1.0940	1.0926	1.0970	1.1017	1.1051	1.1085	(40)
HLP (average)												1.1034	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.8567	26.9875	27.8486	24.2791	23.2964	20.1030	18.6284	21.3764	21.6317	25.2096	27.5183	29.8831	(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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)	41.4740	40.1599	37.4310	33.7210	31.3124	27.9209	25.0382	28.7317	30.0440	33.8839	38.2198	40.1654	(72)
Total internal gains	321.8526	320.4765	309.2085	290.7705	271.3912	253.3336	242.0192	245.7746	255.6259	274.1939	295.5005	312.1122	(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	391.4033	456.5324	533.2732	617.5555	671.8785	663.3036	632.3273	581.0436	516.2225	435.6357	382.2221	369.3073	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	62.2274	62.3344	62.4396	62.9385	63.0327	63.4751	63.4751	63.5577	63.3040	63.0327	62.8424	62.6446	
alpha	5.1485	5.1556	5.1626	5.1959	5.2022	5.2317	5.2317	5.2372	5.2203	5.2022	5.1895	5.1763	
util living area	0.9988	0.9971	0.9905	0.9629	0.8783	0.7115	0.5414	0.6065	0.8644	0.9833	0.9975	0.9991	(86)
MIT	19.7475	19.8969	20.1628	20.5110	20.7992	20.9523	20.9906	20.9836	20.8649	20.4732	20.0426	19.7185	(87)
Th 2	19.9878	19.9894	19.9909	19.9981	19.9994	20.0057	20.0057	20.0069	20.0033	19.9994	19.9967	19.9939	(88)
util rest of house	0.9984	0.9961	0.9871	0.9487	0.8338	0.6223	0.4250	0.4863	0.7977	0.9746	0.9964	0.9988	(89)
MIT 2	18.8419	18.9921	19.2574	19.6024	19.8640	19.9839	20.0033	20.0022	19.9269	19.5722	19.1438	18.8177	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.1630	19.3130	19.5785	19.9246	20.1956	20.3273	20.3534	20.3501	20.2595	19.8917	19.4625	19.1371	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1630	19.3130	19.5785	19.9246	20.1956	20.3273	20.3534	20.3501	20.2595	19.8917	19.4625	19.1371	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9951	0.9853	0.9474	0.8436	0.6528	0.4667	0.5294	0.8172	0.9734	0.9956	0.9985	(94)
Useful gains	390.5924	454.3170	525.4084	585.0934	566.7862	433.0359	295.0861	307.6095	421.8662	424.0271	380.5528	368.7391	(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	1204.5315	1166.0567	1056.3080	883.3617	679.7060	455.0281	298.2031	313.4286	490.6918	743.3988	992.0828	1202.4761	(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	605.5707	478.2891	394.9893	214.7531	84.0123	0.0000	0.0000	0.0000	0.0000	237.6125	440.3016	620.3003	(98)
Space heating												3075.8290	(98)
Space heating per m2											(98) / (4) =	42.3551	(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	746.8234	587.9248	603.0299	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8931	0.9441	0.9214	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	666.9721	555.0761	555.6046	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	861.6133	823.7085	765.3510	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	140.1417	199.8625	156.0513	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												496.0555	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.0354	49.9656	39.0128	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												124.0139	(107)
Space cooling per m2												1.7077	(108)
Energy for space heating												42.3551	(99)
Energy for space cooling												1.7077	(108)
Total												44.0628	(109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1	(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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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) =	0.1721	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4221	(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) =	0.3271	(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	0.4171	0.4089	0.4008	0.3599	0.3517	0.3108	0.3108	0.3026	0.3271	0.3517	0.3680	0.3844	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739	(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-02	28.3400	10.2200	18.1200	0.1800	3.2616			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.1800	4.2282			(29a)
Flat Roof	72.6200		72.6200	0.1300	9.4406			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.5996			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6063	(36)
Total fabric heat loss						(33) + (36) =	43.2059	(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	33.7609	33.5666	33.3762	32.4817	32.3143	31.5353	31.5353	31.3910	31.8354	32.3143	32.6529	33.0069	(38)
Heat transfer coeff	76.9669	76.7726	76.5821	75.6876	75.5203	74.7412	74.7412	74.5969	75.0413	75.5203	75.8588	76.2128	(39)
Average = Sum(39)m / 12 =												75.6868	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0599	1.0572	1.0546	1.0422	1.0399	1.0292	1.0292	1.0272	1.0333	1.0399	1.0446	1.0495	(40)
HLP (average)												1.0422	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.8567	26.9875	27.8486	24.2791	23.2964	20.1030	18.6284	21.3764	21.6317	25.2096	27.5183	29.8831	(65)

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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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	41.4740	40.1599	37.4310	33.7210	31.3124	27.9209	25.0382	28.7317	30.0440	33.8839	38.2198	40.1654	(72)
Total internal gains													
	321.8526	320.4765	309.2085	290.7705	271.3912	253.3336	242.0192	245.7746	255.6259	274.1939	295.5005	312.1122	(73)

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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	0.6300	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	383.1963	440.4778	506.8336	578.9949	624.6210	614.9271	586.2710	541.4818	485.4721	416.5856	371.9889	362.5583	(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	65.5224	65.6882	65.8516	66.6298	66.7775	67.4736	67.4736	67.6041	67.2037	66.7775	66.4795	66.1707	
alpha	5.3682	5.3792	5.3901	5.4420	5.4518	5.4982	5.4982	5.5069	5.4802	5.4518	5.4320	5.4114	
util living area													
	0.9989	0.9975	0.9920	0.9680	0.8900	0.7239	0.5504	0.6139	0.8716	0.9849	0.9977	0.9992	(86)
MIT	19.8133	19.9520	20.2002	20.5312	20.8068	20.9561	20.9919	20.9858	20.8749	20.5050	20.0990	19.7905	(87)
Th 2	20.0338	20.0360	20.0381	20.0483	20.0502	20.0591	20.0591	20.0607	20.0556	20.0502	20.0463	20.0423	(88)
util rest of house													
	0.9986	0.9966	0.9891	0.9557	0.8490	0.6384	0.4382	0.4985	0.8087	0.9772	0.9968	0.9990	(89)
MIT 2	18.9446	19.0848	19.3334	19.6651	19.9178	20.0386	20.0569	20.0565	19.9838	19.6456	19.2403	18.9289	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.2526	19.3923	19.6407	19.9722	20.2330	20.3639	20.3884	20.3860	20.2998	19.9503	19.5448	19.2344	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2526	19.3923	19.6407	19.9722	20.2330	20.3639	20.3884	20.3860	20.2998	19.9503	19.5448	19.2344	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9959	0.9875	0.9545	0.8579	0.6677	0.4784	0.5398	0.8271	0.9761	0.9961	0.9986	(94)
Useful gains	382.4978	438.6517	500.5167	552.6340	535.8477	410.5676	280.4520	292.3036	401.5487	406.6376	370.5533	362.0683	(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													
	1150.8582	1112.6113	1006.3465	838.0310	644.4162	430.8039	283.1529	297.3457	465.2416	706.1370	944.0481	1145.8129	(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													
	571.6601	452.9008	376.3374	205.4858	80.7750	0.0000	0.0000	0.0000	0.0000	222.8276	412.9162	583.1060	(98)
Space heating												2906.0088	(98)
Space heating per m2											(98) / (4) =	40.0166	(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	702.5673	553.0849	566.9367	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8975	0.9483	0.9274	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	630.5314	524.4732	525.7863	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	805.0694	769.8764	719.1100	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	125.6674	182.5800	143.8328	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												452.0802	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.4168	45.6450	35.9582	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												113.0200	(107)
Space cooling per m2												1.5563	(108)
Energy for space heating												40.0166	(99)
Energy for space cooling												1.5563	(108)
Total												41.5730	(109)
Target Fabric Energy Efficiency (TFEE)												47.8	(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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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		3.7000	
Infiltration rate		0.1850	(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) =	0.1434	(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	0.1505	0.1434	0.1434	0.1326	0.1326	0.1183	0.1219	0.1147	0.1183	0.1255	0.1255	0.1362	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)
Effective ac	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-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Flat Roof	72.6200		72.6200	0.1500	10.8930			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0180			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6856	(36)
Total fabric heat loss						(33) + (36) =	48.7036	(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	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	(39)
Average = Sum(39)m / 12 =												77.4611	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	(40)
HLP (average)												1.0667	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0978	12.7129	14.0421	13.5520	13.9767	13.4947	13.9251	13.9586	13.5259	14.0151	13.6061	14.0870	(61)
Total heat required for water heating calculated for each month													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(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													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
								Total per year (kWh/year) = Sum(64)m =				1565.5522	(64)
RHI water heating demand												1566	(64)
Heat gains from water heating, kWh/month													
	51.8061	45.4056	47.0855	41.3777	39.9462	34.8290	32.6292	36.9374	37.2287	42.9494	46.4595	50.2799	(65)

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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	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.5630	43.1332	35.0783	26.5565	19.8513	16.7593	18.1090	23.5388	31.5937	40.1155	46.8207	49.9127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.4822	306.6314	298.6956	281.8010	260.4747	240.4310	227.0406	223.8914	231.8272	248.7218	270.0481	290.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	69.6318	67.5679	63.2869	57.4690	53.6911	48.3736	43.8565	49.6470	51.7065	57.7277	64.5271	67.5806	(72)
Total internal gains													
	521.9935	517.6490	497.3772	466.1430	434.3335	405.8803	389.3225	397.3936	415.4439	446.8814	481.7123	507.9015	(73)

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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	601.0738	656.8023	723.3375	804.7928	837.8491	847.6018	805.4421	763.4801	699.9894	623.0865	582.7277	572.3023	(84)

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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, nil,m (see Table 9a)													
tau	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	
alpha	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	
util living area													
	0.9888	0.9810	0.9536	0.8688	0.6945	0.4531	0.2978	0.3241	0.6189	0.9000	0.9766	0.9910	(86)
MIT	20.1631	20.2796	20.5224	20.7890	20.9503	20.9958	20.9997	20.9995	20.9789	20.7802	20.4249	20.1274	(87)
Th 2	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	(88)
util rest of house													
	0.9852	0.9750	0.9390	0.8313	0.6254	0.3670	0.2046	0.2260	0.5254	0.8613	0.9678	0.9881	(89)
MIT 2	19.2873	19.4015	19.6356	19.8765	20.0014	20.0269	20.0281	20.0281	20.0200	19.8755	19.5452	19.2522	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.5978	19.7128	19.9500	20.2001	20.3379	20.3704	20.3726	20.3725	20.3600	20.1963	19.8572	19.5625	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4478	19.5628	19.8000	20.0501	20.1879	20.2204	20.2226	20.2225	20.2100	20.0463	19.7072	19.4125	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9714	0.9349	0.8323	0.6374	0.3842	0.2233	0.2457	0.5436	0.8621	0.9641	0.9856	(94)
Useful gains	590.4992	638.0314	676.2604	669.8219	534.0102	325.6778	179.8652	187.5726	380.4893	537.1583	561.8316	564.0743	(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													
	1111.3991	1081.5780	960.5208	786.2365	556.7798	326.9204	179.9119	187.6513	388.0799	654.2612	906.8498	1108.6659	(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													
	387.5495	298.0633	211.4897	83.8185	16.9405	0.0000	0.0000	0.0000	0.0000	87.1245	248.4131	405.1761	(98)
Space heating												1738.5752	(98)
RHI space heating demand												1739	(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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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		3.7000	
Infiltration rate		0.1850	(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) =	0.1434	(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	0.1828	0.1792	0.1756	0.1577	0.1541	0.1362	0.1362	0.1326	0.1434	0.1541	0.1613	0.1685	(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-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Flat Roof	72.6200		72.6200	0.1500	10.8930			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0180			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6856	(36)
Total fabric heat loss						(33) + (36) =	48.7036	(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	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	(39)
Average = Sum(39)m / 12 =												77.4611	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	(40)
HLP (average)												1.0667	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     14.0978    12.7129    14.0421    13.5520    13.9767    13.4947    13.9251    13.9586    13.5259    14.0151    13.6061    14.0870 (61)
Total heat required for water heating calculated for each month
              159.3057   139.7127   145.0945   127.8067   123.6068   108.0971   101.5882   114.5532   115.3220   132.6485   143.1038   154.7132 (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
              159.3057   139.7127   145.0945   127.8067   123.6068   108.0971   101.5882   114.5532   115.3220   132.6485   143.1038   154.7132 (64)
                                                                                                 Total per year (kWh/year) = Sum(64)m =   1565.5522 (64)
Heat gains from water heating, kWh/month
               51.8061    45.4056    47.0855    41.3777    39.9462    34.8290    32.6292    36.9374    37.2287    42.9494    46.4595    50.2799 (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         138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               48.5630    43.1332    35.0783    26.5565    19.8513    16.7593    18.1090    23.5388    31.5937    40.1155    46.8207    49.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              303.4822   306.6314   298.6956   281.8010   260.4747   240.4310   227.0406   223.8914   231.8272   248.7218   270.0481   290.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561 (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)
              -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206 (71)
Water heating gains (Table 5)
               69.6318    67.5679    63.2869    57.4690    53.6911    48.3736    43.8565    49.6470    51.7065    57.7277    64.5271    67.5806 (72)
Total internal gains
              521.9935   517.6490   497.3772   466.1430   434.3335   405.8803   389.3225   397.3936   415.4439   446.8814   481.7123   507.9015 (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
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West                                     10.2200          19.6403          0.4500          0.0000          0.7700          69.5507 (80)
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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   591.5442   653.7049   721.4419   792.9280   834.8208   815.8503   779.6307   732.6625   676.0404   608.3232   568.4338   565.0966 (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, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            65.1043    65.1043    65.1043    65.1043    65.1043    65.1043    65.1043    65.1043    65.1043    65.1043    65.1043    65.1043
alpha           5.3403     5.3403     5.3403     5.3403     5.3403     5.3403     5.3403     5.3403     5.3403     5.3403     5.3403     5.3403
util living area
                0.9916     0.9846     0.9642     0.9036     0.7743     0.5902     0.4342     0.4810     0.7297     0.9343     0.9841     0.9934 (86)

MIT            20.0716    20.2075    20.4385    20.7100    20.9028    20.9813    20.9969    20.9948    20.9459    20.6884    20.3207    20.0283 (87)
Th 2           20.0282    20.0282    20.0282    20.0282    20.0282    20.0282    20.0282    20.0282    20.0282    20.0282    20.0282    20.0282 (88)
util rest of house
                0.9890     0.9799     0.9532     0.8752     0.7177     0.5080     0.3399     0.3822     0.6490     0.9083     0.9784     0.9913 (89)
MIT 2          19.1966    19.3305    19.5551    19.8075    19.9678    20.0203    20.0274    20.0268    20.0013    19.7947    19.4434    19.1537 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3546 (91)
MIT            19.5068    19.6415    19.8683    20.1275    20.2993    20.3611    20.3712    20.3700    20.3363    20.1116    19.7545    19.4638 (92)
Temperature adjustment                                                                                                          -0.1500
adjusted MIT   19.3568    19.4915    19.7183    19.9775    20.1493    20.2111    20.2212    20.2200    20.1863    19.9616    19.6045    19.3138 (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     0.9867     0.9766     0.9489     0.8736     0.7253     0.5240     0.3588     0.4020     0.6631     0.9061     0.9752     0.9893 (94)
Useful gains  583.6720   638.4258   684.5856   692.6645   605.4707   427.4721   279.7365   294.5078   448.2749   551.2241   554.3175   559.0591 (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
             1166.3185  1130.2731  1023.9071   858.0787   654.4954   434.6385   280.5023   295.9045   471.4481   725.1597   968.6121  1170.7344 (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
              433.4890   330.5214   252.4553   119.0983    36.4744     0.0000     0.0000     0.0000     0.0000   129.4080   298.2921   455.0864 (98)
Space heating                                                                                                                   2054.8250 (98)
Space heating per m2                                                                                                 (98) / (4) =     28.2956 (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

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	2270.5248	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	433.4890	330.5214	252.4553	119.0983	36.4744	0.0000	0.0000	0.0000	0.0000	129.4080	298.2921	455.0864	(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)	478.9934	365.2170	278.9561	131.6003	40.3032	0.0000	0.0000	0.0000	0.0000	142.9923	329.6046	502.8579	(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	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6172	89.5250	89.3053	88.8148	88.0090	87.3000	87.3000	87.3000	87.3000	88.8514	89.4371	89.6661	(217)
Fuel for water heating, kWh/month	177.7624	156.0599	162.4703	143.9024	140.4478	123.8226	116.3667	131.2179	132.0985	149.2925	160.0049	172.5436	(219)
Water heating fuel used												1765.9895	(219)

Annual totals kWh/year

Space heating fuel - main system	2270.5248	(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)	39.1242	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1242	(231)
Electricity for lighting (calculated in Appendix L)	343.0552	(232)
Total delivered energy for all uses	4493.6936	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2270.5248	3.4800	79.0143	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1765.9895	3.4800	61.4564	(247)
Mechanical ventilation fans	39.1242	13.1900	5.1605	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	343.0552	13.1900	45.2490	(250)
Additional standing charges			120.0000	(251)
Total energy cost			320.7727	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1454	(257)
SAP value		84.0214	
SAP rating (Section 12)		84	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2270.5248	0.2160	490.4334	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1765.9895	0.2160	381.4537	(264)
Space and water heating			871.8871	(265)
Pumps and fans	114.1242	0.5190	59.2304	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total kg/year			1109.1632	(272)
CO2 emissions per m2			15.2700	(273)
EI value			87.3637	
EI rating			87	(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 / 0.8854 = 3.931, stars = 4
Water heating environmental impact	0.216 / 0.8854 = 0.2440, 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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(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		3.7000	
Infiltration rate		0.1850	(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) =	0.1434	(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	0.1505	0.1434	0.1434	0.1326	0.1326	0.1183	0.1219	0.1147	0.1183	0.1255	0.1255	0.1362	(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-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Flat Roof	72.6200		72.6200	0.1500	10.8930			(30)
Total net area of external elements Aum(A, m2)			126.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0180			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6856	(36)
Total fabric heat loss						(33) + (36) =	48.7036	(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	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	77.4611	(39)
Average = Sum(39)m / 12 =												77.4611	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	1.0667	(40)
HLP (average)												1.0667	(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	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(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	14.0978	12.7129	14.0421	13.5520	13.9767	13.4947	13.9251	13.9586	13.5259	14.0151	13.6061	14.0870	(61)
Total heat required for water heating calculated for each month													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(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													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
								Total per year (kWh/year) = Sum(64)m =				1565.5522	(64)
Heat gains from water heating, kWh/month													
	51.8061	45.4056	47.0855	41.3777	39.9462	34.8290	32.6292	36.9374	37.2287	42.9494	46.4595	50.2799	(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	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.5630	43.1332	35.0783	26.5565	19.8513	16.7593	18.1090	23.5388	31.5937	40.1155	46.8207	49.9127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.4822	306.6314	298.6956	281.8010	260.4747	240.4310	227.0406	223.8914	231.8272	248.7218	270.0481	290.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	69.6318	67.5679	63.2869	57.4690	53.6911	48.3736	43.8565	49.6470	51.7065	57.7277	64.5271	67.5806	(72)
Total internal gains													
	521.9935	517.6490	497.3772	466.1430	434.3335	405.8803	389.3225	397.3936	415.4439	446.8814	481.7123	507.9015	(73)

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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	601.0738	656.8023	723.3375	804.7928	837.8491	847.6018	805.4421	763.4801	699.9894	623.0865	582.7277	572.3023	(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	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	65.1043	
alpha	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	5.3403	
util living area													
	0.9888	0.9810	0.9536	0.8688	0.6945	0.4531	0.2978	0.3241	0.6189	0.9000	0.9766	0.9910	(86)
MIT	20.1631	20.2796	20.5224	20.7890	20.9503	20.9958	20.9997	20.9995	20.9789	20.7802	20.4249	20.1274	(87)
Th 2	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	20.0282	(88)
util rest of house													
	0.9852	0.9750	0.9390	0.8313	0.6254	0.3670	0.2046	0.2260	0.5254	0.8613	0.9678	0.9881	(89)
MIT 2	19.2873	19.4015	19.6356	19.8765	20.0014	20.0269	20.0281	20.0281	20.0200	19.8755	19.5452	19.2522	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.5978	19.7128	19.9500	20.2001	20.3379	20.3704	20.3726	20.3725	20.3600	20.1963	19.8572	19.5625	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4478	19.5628	19.8000	20.0501	20.1879	20.2204	20.2226	20.2225	20.2100	20.0463	19.7072	19.4125	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9714	0.9349	0.8323	0.6374	0.3842	0.2233	0.2457	0.5436	0.8621	0.9641	0.9856	(94)
Useful gains	590.4992	638.0314	676.2604	669.8219	534.0102	325.6778	179.8652	187.5726	380.4893	537.1583	561.8316	564.0743	(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													
	1111.3991	1081.5780	960.5208	786.2365	556.7798	326.9204	179.9119	187.6513	388.0799	654.2612	906.8498	1108.6659	(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													
	387.5495	298.0633	211.4897	83.8185	16.9405	0.0000	0.0000	0.0000	0.0000	87.1245	248.4131	405.1761	(98)
Space heating												1738.5752	(98)
Space heating per m2											(98) / (4) =	23.9407	(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	1921.0776	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	387.5495	298.0633	211.4897	83.8185	16.9405	0.0000	0.0000	0.0000	0.0000	87.1245	248.4131	405.1761	(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)	428.2315	329.3518	233.6903	92.6171	18.7188	0.0000	0.0000	0.0000	0.0000	96.2702	274.4896	447.7084	(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	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
Efficiency of water heater (217)m	89.5438	89.4536	89.1700	88.5400	87.6737	87.3000	87.3000	87.3000	87.3000	88.5411	89.3035	89.5925	(217)
Fuel for water heating, kWh/month	177.9081	156.1846	162.7167	144.3491	140.9851	123.8226	116.3667	131.2179	132.0985	149.8158	160.2443	172.6853	(219)

Water heating fuel used	1768.3945	(219)
Annual totals kWh/year		
Space heating fuel - main system	1921.0776	(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)	39.1242	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1242	(231)
Electricity for lighting (calculated in Appendix L)	343.0552	(232)
Total delivered energy for all uses	4146.6515	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1921.0776	3.7400	71.8483	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1768.3945	3.7400	66.1380	(247)
Mechanical ventilation fans	39.1242	19.1200	7.4805	(249)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Energy for lighting	343.0552	19.1200	65.5922	(250)
Additional standing charges			94.0000	(251)
Total energy cost			319.3990	(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	1921.0776	0.2160	414.9528	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1768.3945	0.2160	381.9732	(264)
Space and water heating			796.9260	(265)
Pumps and fans	114.1242	0.5190	59.2304	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total kg/year			1034.2021	(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	1921.0776	1.2200	2343.7147	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1768.3945	1.2200	2157.4413	(264)
Space and water heating			4501.1560	(265)
Pumps and fans	114.1242	3.0700	350.3612	(267)
Energy for lighting	343.0552	3.0700	1053.1794	(268)
Primary energy kWh/year			5904.6967	(272)
Primary energy kWh/m2/year			81.3095	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 87

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

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 485 TEST (29 Oct 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£87	£87	£0
Mains gas	£232	£232	£0
Space heating	£188	£188	£0
Water heating	£66	£66	£0
Lighting	£66	£66	£0
Total cost of fuels	£319	£319	£0
Total cost of uses	£320	£320	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	81 kWh/m²	81 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	345.09	(P1)
Transmission heat loss coefficient	48.70	(37)
Summer heat loss coefficient	393.79	(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	403	386	394	
Total summer gains	919	873	822	(P5)
Summer gain/loss ratio	2.33	2.22	2.09	(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	18.58	20.37	20.14	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant