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

Property Reference	SECPMW026s_087_As_Built	**Issued on Date**	07/05/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	86 B	**DER**	12.73	**TER**	14.52
Environmental	90 B	**% DER<TER**	12.33		
CO_2 Emissions (t/year)	0.79	**DFEE**	24.12	**TFEE**	28.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.65		

Assessor Details	Mr. Robert Price, Robert Price, Tel: 01635 261582, keith@southernenergyconsultants.co.uk	**Assessor ID**	P865-0001
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 71 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) 14.52 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.73 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)28.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)24.1 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: 3.26 (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): Slight OK
Based on:
Overshading: Average
Windows facing South: 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 3.3 m³/m²h

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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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		3.2600	
Infiltration rate		0.1630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1386	(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	0.1767	0.1732	0.1697	0.1524	0.1489	0.1316	0.1316	0.1282	0.1386	0.1489	0.1559	0.1628	(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	41.2400	10.2200	31.0200	0.1600	4.9632			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1584	0.8491			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.5616			(33)
Party Wall 1			33.8400	0.0000	0.0000			(32)
Party Floor 1			71.1200					(32d)
Party Ceilings 1			71.1200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5768	(36)
Total fabric heat loss (33) + (36) =	27.1384	(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	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	(38)
Heat transfer coeff	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	(39)
Average = Sum(39)m / 12 =												55.3019	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	(40)
HLP (average)												0.7776	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5777	18.8720	19.4742	16.9781	16.2909	14.0578	13.0266	14.9482	15.1268	17.6288	19.2432	20.8969	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0915	12.7075	14.0368	13.5476	13.9726	13.4913	13.9220	13.9548	13.5220	14.0103	13.6006	14.0809	(61)
Total heat required for water heating calculated for each month	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(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	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(64)
Total per year (kWh/year) = Sum(64)m =												1552.4138	(64)
Heat gains from water heating, kWh/month	51.3535	45.0099	46.6771	41.0217	39.6047	34.5343	32.3562	36.6240	36.9115	42.5797	46.0559	49.8417	(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	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0110	16.8854	13.7321	10.3961	7.7712	6.5608	7.0891	9.2147	12.3680	15.7040	18.3289	19.5393	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.8968	201.9711	196.7439	185.6159	171.5687	158.3664	149.5464	147.4721	152.6993	163.8273	177.8745	191.0768	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	(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)	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	(71)
Water heating gains (Table 5)	69.0235	66.9790	62.7380	56.9746	53.2321	47.9643	43.4895	49.2258	51.2660	57.2308	63.9666	66.9915	(72)
Total internal gains	348.0264	345.9306	333.3092	313.0817	292.6671	272.9866	260.2202	266.0077	276.4284	296.8573	320.2651	337.7027	(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	
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	513.5862	617.0749	678.6989	703.4471	699.4520	664.4617	642.7152	637.4634	637.2288	589.3119	516.5099	480.7617	(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	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	
alpha	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	
util living area	0.9339	0.8889	0.8314	0.7521	0.6423	0.5011	0.3697	0.3881	0.5514	0.7623	0.8963	0.9449	(86)
MIT	19.7197	20.0140	20.3147	20.5960	20.8124	20.9395	20.9834	20.9799	20.9128	20.6368	20.1182	19.6306	(87)
Th 2	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	(88)
util rest of house	0.9263	0.8770	0.8141	0.7268	0.6061	0.4517	0.3116	0.3303	0.5035	0.7331	0.8831	0.9384	(89)
MIT 2	19.0971	19.3817	19.6696	19.9334	20.1282	20.2336	20.2646	20.2625	20.2136	19.9760	19.4873	19.0103	(90)
Living area fraction									fLA = Living area / (4) =			0.3346	(91)
MIT	19.3055	19.5933	19.8855	20.1551	20.3572	20.4698	20.5052	20.5025	20.4476	20.1971	19.6984	19.2179	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1555	19.4433	19.7355	20.0051	20.2072	20.3198	20.3552	20.3525	20.2976	20.0471	19.5484	19.0679	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9122	0.8617	0.8000	0.7168	0.6027	0.4550	0.3183	0.3368	0.5052	0.7233	0.8680	0.9252	(94)
Useful gains	468.5140	531.7030	542.9577	504.2641	421.5744	302.3038	204.5639	214.6983	321.9093	426.2360	448.3280	444.8157	(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	821.5368	804.2715	731.9474	614.1359	470.4636	316.3163	207.6671	218.5834	342.7377	522.4441	688.4229	822.2225	(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	262.6490	183.1660	140.6083	79.1077	36.3735	0.0000	0.0000	0.0000	0.0000	71.5789	172.8683	280.7906	(98)
Space heating												1227.1424	(98)
Space heating per m2											(98) / (4) =	17.2545	(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	1355.9584	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	262.6490	183.1660	140.6083	79.1077	36.3735	0.0000	0.0000	0.0000	0.0000	71.5789	172.8683	280.7906	(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)	290.2199	202.3934	155.3683	87.4118	40.1918	0.0000	0.0000	0.0000	0.0000	79.0927	191.0147	310.2659	(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	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.2712	89.0937	88.8529	88.5027	88.0121	87.3000	87.3000	87.3000	87.3000	88.4016	89.0289	89.3430	(217)
Fuel for water heating, kWh/month	176.9250	155.4779	161.9138	143.1991	139.2747	122.8065	115.4252	130.1372	131.0047	148.7933	159.3737	171.6905	(219)
Water heating fuel used												1756.0216	(219)

Annual totals kWh/year		
Space heating fuel - main system	1355.9584	(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)	38.3160	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.3160	(231)
Electricity for lighting (calculated in Appendix L)	335.7397	(232)
Total delivered energy for all uses	3561.0358	(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	1355.9584	0.2160	292.8870	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1756.0216	0.2160	379.3007	(264)
Space and water heating			672.1877	(265)
Pumps and fans	113.3160	0.5190	58.8110	(267)
Energy for lighting	335.7397	0.5190	174.2489	(268)
Total CO2, kg/year			905.2476	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7300	(273)

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

DER		12.7300	ZC1
Total Floor Area	TFA	71.1200	
Assumed number of occupants	N	2.2730	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6556	ZC2
CO2 emissions from cooking, equation (L16)		2.4403	ZC3
Total CO2 emissions		31.8259	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		31.8259	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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							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) =	0.1758	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4258	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3619	(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	0.4614	0.4524	0.4433	0.3981	0.3890	0.3438	0.3438	0.3348	0.3619	0.3890	0.4071	0.4252	(22b)
Effective ac	0.6065	0.6023	0.5983	0.5792	0.5757	0.5591	0.5591	0.5560	0.5655	0.5757	0.5829	0.5904	(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	41.2400	10.2200	31.0200	0.1800	5.5836			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1800	0.9648			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.2176			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0115	(36)
Total fabric heat loss					(33) + (36) =		27.2291	(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	34.1597	33.9268	33.6986	32.6266	32.4261	31.4924	31.4924	31.3195	31.8520	32.4261	32.8318	33.2560	(38)
Heat transfer coeff	61.3888	61.1560	60.9278	59.8558	59.6552	58.7216	58.7216	58.5487	59.0812	59.6552	60.0610	60.4851	(39)
Average = Sum(39)m / 12 =												59.8548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8632	0.8599	0.8567	0.8416	0.8388	0.8257	0.8257	0.8232	0.8307	0.8388	0.8445	0.8505	(40)
HLP (average)												0.8416	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5777	18.8720	19.4742	16.9781	16.2909	14.0578	13.0266	14.9482	15.1268	17.6288	19.2432	20.8969	(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	49.4313	43.0241	45.8363	42.6182	42.2413	39.1392	40.4438	42.2413	42.6182	45.8363	46.0972	49.4313	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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Total heat required for water heating calculated for each month
                193.2829   168.8376   175.6646   155.8056   150.8473   132.8579   127.2880   141.8963   143.4634   163.3616   174.3853   188.7439 (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
                193.2829   168.8376   175.6646   155.8056   150.8473   132.8579   127.2880   141.8963   143.4634   163.3616   174.3853   188.7439 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1916.4343 (64)
Heat gains from water heating, kWh/month
                 60.1885    52.5890    54.6270    48.2894    46.6718    40.9463    38.9866    43.6956    44.1856    50.5362    54.1801    58.6793 (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           113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                 19.0110    16.8854    13.7321    10.3961     7.7712     6.5608     7.0891     9.2147    12.3680    15.7040    18.3289    19.5393 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
                199.8968   201.9711   196.7439   185.6159   171.5687   158.3664   149.5464   147.4721   152.6993   163.8273   177.8745   191.0768 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                 34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650 (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)
                -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202 (71)
Water heating gains (Table 5)
                 80.8985    78.2575    73.4234    67.0686    62.7310    56.8698    52.4014    58.7307    61.3688    67.9251    75.2501    78.8700 (72)
Total internal gains
                359.9014   357.2090   343.9945   323.1756   302.1660   281.8921   269.1321   275.5126   286.5312   307.5515   331.5486   349.5812 (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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South                                    10.2200          46.7521           0.6300           0.7000           0.7700         146.0238 (78)
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Solar gains     146.0238   239.1493   304.6338   344.3023   358.7843   345.2811   337.3606   327.6239   318.2259   257.9449   173.0879   126.1780 (83)
Total gains     505.9251   596.3583   648.6283   667.4779   660.9503   627.1731   606.4927   603.1365   604.7572   565.4965   504.6366   475.7592 (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             80.4526    80.7589    81.0614    82.5131    82.7906    84.1069    84.1069    84.3553    83.5949    82.7906    82.2313    81.6546
alpha            6.3635     6.3839     6.4041     6.5009     6.5194     6.6071     6.6071     6.6237     6.5730     6.5194     6.4821     6.4436
util living area
                 0.9943     0.9835     0.9591     0.8993     0.7806     0.5909     0.4251     0.4454     0.6568     0.9036     0.9845     0.9960 (86)

MIT             20.2725    20.4450    20.6354    20.8265    20.9456    20.9927    20.9993    20.9990    20.9853    20.8468    20.5273    20.2426 (87)
Th 2            20.1989    20.2017    20.2045    20.2174    20.2198    20.2311    20.2311    20.2332    20.2268    20.2198    20.2149    20.2098 (88)
util rest of house
                 0.9926     0.9788     0.9476     0.8730     0.7318     0.5236     0.3513     0.3718     0.5901     0.8733     0.9792     0.9948 (89)
MIT 2           19.2319    19.4828    19.7543    20.0233    20.1694    20.2264    20.2309    20.2328    20.2163    20.0558    19.6137    19.1970 (90)
Living area fraction                                                                                     fLA = Living area / (4) =      0.3346 (91)
MIT             19.5801    19.8048    20.0492    20.2921    20.4292    20.4828    20.4880    20.4892    20.4737    20.3205    19.9195    19.5469 (92)
Temperature adjustment                                                                                                               0.0000
adjusted MIT    19.5801    19.8048    20.0492    20.2921    20.4292    20.4828    20.4880    20.4892    20.4737    20.3205    19.9195    19.5469 (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      0.9908     0.9759     0.9450     0.8758     0.7455     0.5459     0.3761     0.3964     0.6119     0.8776     0.9767     0.9934 (94)
Useful gains   501.2924   581.9920   612.9841   584.5454   492.7334   342.4006   228.0854   239.1006   370.0720   496.3032   492.8950   472.6124 (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
               938.0304   911.5169   825.5202   681.8843   520.7394   345.4501   228.3094   239.4183   376.5644   579.8774   769.9486   928.2583 (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
               324.9331   221.4407   158.1269    70.0840    20.8365     0.0000     0.0000     0.0000     0.0000    62.1792   199.4786   339.0006 (98)
Space heating                                                                                                                     1396.0796 (98)
Space heating per m2                                                                                                  (98) / (4) =     19.6299 (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												1494.7319	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	324.9331	221.4407	158.1269	70.0840	20.8365	0.0000	0.0000	0.0000	0.0000	62.1792	199.4786	339.0006	(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)	347.8941	237.0886	169.3007	75.0364	22.3088	0.0000	0.0000	0.0000	0.0000	66.5730	213.5745	362.9556	(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	193.2829	168.8376	175.6646	155.8056	150.8473	132.8579	127.2880	141.8963	143.4634	163.3616	174.3853	188.7439	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.3491	85.7349	84.7876	83.1835	81.4038	80.3000	80.3000	80.3000	80.3000	82.8520	85.3903	86.5085	(217)
Fuel for water heating, kWh/month	223.8388	196.9298	207.1819	187.3036	185.3075	165.4519	158.5156	176.7077	178.6592	197.1729	204.2214	218.1795	(219)
Water heating fuel used												2299.4697	(219)
Annual totals kWh/year													
Space heating fuel - main system												1494.7319	(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)	335.7397	(232)
Total delivered energy for all uses	4204.9413	(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	1494.7319	0.2160	322.8621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2299.4697	0.2160	496.6855	(264)
Space and water heating			819.5476	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	335.7397	0.5190	174.2489	(268)
Total CO2, kg/m2/year			1032.7215	(272)
Emissions per m2 for space and water heating			11.5234	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4501	(272b)
Emissions per m2 for pumps and fans			0.5473	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.5234 * 1.00) + 2.4501 + 0.5473, rounded to 2 d.p.			14.5200	(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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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) =	0.1758	(8)
Pressure test		Yes	
Measured/design AP50		3.2600	
Infiltration rate		0.3388	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2879	(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	0.3671	0.3599	0.3527	0.3167	0.3095	0.2735	0.2735	0.2663	0.2879	0.3095	0.3239	0.3383	(22b)
Effective ac	0.5674	0.5648	0.5622	0.5502	0.5479	0.5374	0.5374	0.5355	0.5415	0.5479	0.5525	0.5572	(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	41.2400	10.2200	31.0200	0.1600	4.9632			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1584	0.8491			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5616			(33)
Party Wall 1			33.8400	0.0000	0.0000			(32)
Party Floor 1			71.1200					(32d)
Party Ceilings 1			71.1200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5768	(36)
Total fabric heat loss (33) + (36) =	27.1384	(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	31.9595	31.8121	31.6676	30.9890	30.8620	30.2710	30.2710	30.1615	30.4986	30.8620	31.1189	31.3874	(38)
Heat transfer coeff	59.0979	58.9505	58.8060	58.1274	58.0004	57.4094	57.4094	57.2999	57.6370	58.0004	58.2573	58.5258	(39)
Average = Sum(39)m / 12 =												58.1268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8310	0.8289	0.8269	0.8173	0.8155	0.8072	0.8072	0.8057	0.8104	0.8155	0.8191	0.8229	(40)
HLP (average)												0.8173	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(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	30.5685	26.7354	27.5885	24.0523	23.0788	19.9152	18.4544	21.1767	21.4296	24.9741	27.2612	29.6039	(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	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	113.6503	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0110	16.8854	13.7321	10.3961	7.7712	6.5608	7.0891	9.2147	12.3680	15.7040	18.3289	19.5393	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.8968	201.9711	196.7439	185.6159	171.5687	158.3664	149.5464	147.4721	152.6993	163.8273	177.8745	191.0768	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	34.3650	(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)	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	(71)
Water heating gains (Table 5)	41.0866	39.7848	37.0813	33.4060	31.0199	27.6600	24.8043	28.4633	29.7633	33.5674	37.8628	39.7902	(72)
Total internal gains	317.0895	315.7364	304.6525	286.5131	267.4549	249.6823	238.5350	242.2452	251.9257	270.1938	291.1613	307.5015	(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	
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	482.6493	586.8807	650.0422	676.8785	674.2398	641.1574	621.0300	613.7009	612.7261	562.6484	487.4062	450.5604	(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	33.4285	33.5121	33.5944	33.9866	34.0610	34.4117	34.4117	34.4775	34.2758	34.0610	33.9109	33.7553	
alpha	3.2286	3.2341	3.2396	3.2658	3.2707	3.2941	3.2941	3.2985	3.2851	3.2707	3.2607	3.2504	
util living area	0.9467	0.9073	0.8556	0.7800	0.6745	0.5300	0.3940	0.4140	0.5837	0.7918	0.9141	0.9555	(86)
MIT	19.5031	19.8223	20.1613	20.5021	20.7595	20.9214	20.9775	20.9729	20.8861	20.5519	19.9665	19.4341	(87)
Th 2	20.2266	20.2284	20.2301	20.2384	20.2399	20.2471	20.2471	20.2484	20.2443	20.2399	20.2368	20.2335	(88)
util rest of house	0.9400	0.8966	0.8394	0.7553	0.6375	0.4777	0.3309	0.3514	0.5334	0.7634	0.9023	0.9499	(89)
MIT 2	18.8497	19.1615	19.4896	19.8186	20.0538	20.1960	20.2360	20.2345	20.1666	19.8717	19.3132	18.7875	(90)
Living area fraction									fLA = Living area / (4) =			0.3346	(91)
MIT	19.0684	19.3827	19.7144	20.0473	20.2900	20.4388	20.4841	20.4816	20.4074	20.0993	19.5318	19.0039	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0684	19.3827	19.7144	20.0473	20.2900	20.4388	20.4841	20.4816	20.4074	20.0993	19.5318	19.0039	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9281	0.8831	0.8273	0.7486	0.6401	0.4914	0.3511	0.3711	0.5447	0.7578	0.8897	0.9389	(94)
Useful gains	447.9501	518.2642	537.7641	506.7103	431.5572	315.0689	218.0281	227.7708	333.7482	426.3473	433.6439	423.0307	(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	872.7792	853.7600	777.0851	647.9647	498.2234	335.1991	222.9840	233.8739	363.5390	550.9656	724.2438	866.4094	(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	316.0729	225.4532	178.0548	101.7031	49.5996	0.0000	0.0000	0.0000	0.0000	92.7160	209.2319	329.8738	(98)
Space heating												1502.7053	(98)
Space heating per m2											(98) / (4) =	21.1292	(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	539.6480	424.8293	435.4793	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9006	0.9393	0.9343	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	486.0241	399.0479	406.8657	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	834.3692	809.1740	802.1479	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	250.8085	305.1338	294.0899	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												850.0322	(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	62.7021	76.2835	73.5225	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												212.5081	(107)
Space cooling per m2												2.9880	(108)
Energy for space heating												21.1292	(99)
Energy for space cooling												2.9880	(108)
Total												24.1172	(109)
Dwelling Fabric Energy Efficiency (DFEE)												24.1	(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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							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) =	0.1758	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4258	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3619	(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	0.4614	0.4524	0.4433	0.3981	0.3890	0.3438	0.3438	0.3348	0.3619	0.3890	0.4071	0.4252	(22b)
Effective ac	0.6065	0.6023	0.5983	0.5792	0.5757	0.5591	0.5591	0.5560	0.5655	0.5757	0.5829	0.5904	(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	41.2400	10.2200	31.0200	0.1800	5.5836			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1800	0.9648			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.2176			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0115	(36)
Total fabric heat loss					(33) + (36) =		27.2291	(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	34.1597	33.9268	33.6986	32.6266	32.4261	31.4924	31.4924	31.3195	31.8520	32.4261	32.8318	33.2560	(38)
Heat transfer coeff	61.3888	61.1560	60.9278	59.8558	59.6552	58.7216	58.7216	58.5487	59.0812	59.6552	60.0610	60.4851	(39)
Average = Sum(39)m / 12 =												59.8548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8632	0.8599	0.8567	0.8416	0.8388	0.8257	0.8257	0.8232	0.8307	0.8388	0.8445	0.8505	(40)
HLP (average)												0.8416	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(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
                30.5685    26.7354    27.5885    24.0523    23.0788    19.9152    18.4544    21.1767    21.4296    24.9741    27.2612    29.6039 (65)


-----------------------------------------------------------------------------------------------------------------
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          113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503   113.6503 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                19.0110    16.8854    13.7321    10.3961     7.7712     6.5608     7.0891     9.2147    12.3680    15.7040    18.3289    19.5393 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               199.8968   201.9711   196.7439   185.6159   171.5687   158.3664   149.5464   147.4721   152.6993   163.8273   177.8745   191.0768 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650    34.3650 (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)
               -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202 (71)
Water heating gains (Table 5)
                41.0866    39.7848    37.0813    33.4060    31.0199    27.6600    24.8043    28.4633    29.7633    33.5674    37.8628    39.7902 (72)
Total internal gains
               317.0895   315.7364   304.6525   286.5131   267.4549   249.6823   238.5350   242.2452   251.9257   270.1938   291.1613   307.5015 (73)


-----------------------------------------------------------------------------------------------------------------
6. Solar gains
-----------------------------------------------------------------------------------------------------------------

[Jan]                                      Area        Solar flux              g              FF          Access            Gains
                                            m2          Table 6a     Specific data     Specific data      factor              W
                                                          W/m2       or Table 6b       or Table 6c     Table 6d
-----------------------------------------------------------------------------------------------------------------
South                                    10.2200          46.7521          0.6300           0.7000        0.7700         146.0238 (78)
-----------------------------------------------------------------------------------------------------------------

Solar gains    146.0238   239.1493   304.6338   344.3023   358.7843   345.2811   337.3606   327.6239   318.2259   257.9449   173.0879   126.1780 (83)
Total gains    463.1133   554.8856   609.2862   630.8154   626.2392   594.9634   575.8956   569.8691   570.1517   528.1388   464.2493   433.6795 (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            80.4526    80.7589    81.0614    82.5131    82.7906    84.1069    84.1069    84.3553    83.5949    82.7906    82.2313    81.6546
alpha           6.3635     6.3839     6.4041     6.5009     6.5194     6.6071     6.6071     6.6237     6.5730     6.5194     6.4821     6.4436
util living area
                0.9965     0.9886     0.9693     0.9185     0.8092     0.6201     0.4474     0.4709     0.6906     0.9258     0.9900     0.9976 (86)

MIT            20.2146    20.3921    20.5914    20.7974    20.9327    20.9904    20.9990    20.9986    20.9805    20.8160    20.4753    20.1850 (87)
Th 2           20.1989    20.2017    20.2045    20.2174    20.2198    20.2311    20.2311    20.2332    20.2268    20.2198    20.2149    20.2098 (88)
util rest of house
                0.9954     0.9852     0.9602     0.8955     0.7621     0.5506     0.3699     0.3933     0.6228     0.9002     0.9864     0.9969 (89)
MIT 2          19.4813    19.6592    19.8558    20.0600    20.1764    20.2268    20.2309    20.2328    20.2171    20.0820    19.7538    19.4611 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.3346 (91)
MIT            19.7267    19.9045    20.1020    20.3067    20.4295    20.4824    20.4879    20.4891    20.4726    20.3276    19.9952    19.7034 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT   19.7267    19.9045    20.1020    20.3067    20.4295    20.4824    20.4879    20.4891    20.4726    20.3276    19.9952    19.7034 (93)


-----------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-----------------------------------------------------------------------------------------------------------------

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9946     0.9837     0.9589     0.8984     0.7755     0.5738     0.3959     0.4193     0.6450     0.9041     0.9852     0.9963 (94)
Useful gains   460.6051   545.8234   584.2157   566.7172   485.6293   341.3678   227.9997   238.9663   367.7633   477.5164   457.3595   432.0541 (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
               947.0270   917.6130   828.7376   682.7588   520.7613   345.4209   228.3050   239.4113   376.4998   580.3036   774.5010   937.7230 (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
               361.8979   249.8426   181.9243    83.5500    26.1382     0.0000     0.0000     0.0000     0.0000    76.4737   228.3419   376.2176 (98)
Space heating                                                                                                                   1584.3861 (98)
Space heating per m2                                                                                                 (98) / (4) =     22.2776 (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   551.9827   434.5395   444.9698     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation     0.0000     0.0000     0.0000     0.0000     0.0000     0.9680     0.9889     0.9870     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss     0.0000     0.0000     0.0000     0.0000     0.0000   534.3187   429.7216   439.1996     0.0000     0.0000     0.0000     0.0000 (102)
Total gains     0.0000     0.0000     0.0000     0.0000     0.0000   780.3762   756.4195   750.9160     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   177.1614   243.0632   231.9170     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                   652.1416 (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	44.2903	60.7658	57.9793	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												163.0354	(107)
Space cooling per m2												2.2924	(108)
Energy for space heating												22.2776	(99)
Energy for space cooling												2.2924	(108)
Total												24.5700	(109)
Target Fabric Energy Efficiency (TFEE)												28.3	(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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							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		3.2600	
Infiltration rate		0.1630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1386	(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	0.1455	0.1386	0.1386	0.1282	0.1282	0.1143	0.1178	0.1108	0.1143	0.1212	0.1212	0.1316	(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	41.2400	10.2200	31.0200	0.1600	4.9632			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1584	0.8491			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5616			(33)
Party Wall 1			33.8400	0.0000	0.0000			(32)
Party Floor 1			71.1200					(32d)
Party Ceilings 1			71.1200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5768	(36)
Total fabric heat loss (33) + (36) =	27.1384	(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	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	(38)
Heat transfer coeff	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	(39)
Average = Sum(39)m / 12 =												55.3019	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	(40)
HLP (average)												0.7776	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5777	18.8720	19.4742	16.9781	16.2909	14.0578	13.0266	14.9482	15.1268	17.6288	19.2432	20.8969	(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	14.0915	12.7075	14.0368	13.5476	13.9726	13.4913	13.9220	13.9548	13.5220	14.0103	13.6006	14.0809	(61)
Total heat required for water heating calculated for each month													
	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(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													
	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(64)
								Total per year (kWh/year) = Sum(64)m =				1552.4138	(64)
RHI water heating demand												1552	(64)
Heat gains from water heating, kWh/month													
	51.3535	45.0099	46.6771	41.0217	39.6047	34.5343	32.3562	36.6240	36.9115	42.5797	46.0559	49.8417	(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	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.5274	42.2134	34.3303	25.9902	19.4280	16.4019	17.7229	23.0369	30.9200	39.2601	45.8223	48.8484	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.3535	301.4494	293.6477	277.0387	256.0728	236.3678	223.2036	220.1076	227.9094	244.5184	265.4843	285.1893	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	(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)													
	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	(71)
Water heating gains (Table 5)													
	69.0235	66.9790	62.7380	56.9746	53.2321	47.9643	43.4895	49.2258	51.2660	57.2308	63.9666	66.9915	(72)
Total internal gains													
	514.2756	510.0130	490.0872	459.3746	428.1040	400.1052	383.7872	391.7414	409.4666	440.3805	474.6444	500.4003	(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	
South	10.2200	50.9848	0.4500	0.0000	0.7700	180.5490	(78)

Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394	(83)
Total gains	694.8246	775.3793	823.4540	849.0064	826.3931	811.9880	781.1344	783.7786	787.1799	745.6744	693.7100	655.0397	(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, nil,m (see Table 9a)													
tau	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	
alpha	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	
util living area													
	0.8530	0.8065	0.7356	0.6348	0.5032	0.3346	0.2185	0.2246	0.3956	0.6186	0.7853	0.8700	(86)
MIT	20.1733	20.3474	20.5779	20.7841	20.9234	20.9861	20.9977	20.9974	20.9731	20.8312	20.4978	20.1075	(87)
Th 2	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	(88)
util rest of house													
	0.8385	0.7890	0.7127	0.6047	0.4638	0.2878	0.1677	0.1741	0.3493	0.5829	0.7633	0.8566	(89)
MIT 2	19.5331	19.6969	19.9123	20.0991	20.2183	20.2653	20.2720	20.2719	20.2567	20.1430	19.8424	19.4710	(90)
Living area fraction									fLA = Living area / (4) =			0.3346	(91)
MIT	19.7473	19.9146	20.1350	20.3283	20.4543	20.5065	20.5149	20.5147	20.4965	20.3733	20.0617	19.6840	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5973	19.7646	19.9850	20.1783	20.3043	20.3565	20.3649	20.3647	20.3465	20.2233	19.9117	19.5340	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8236	0.7757	0.7031	0.6007	0.4656	0.2933	0.1741	0.1805	0.3541	0.5803	0.7514	0.8414	(94)
Useful gains	572.2383	601.4536	578.9734	509.9620	384.7541	238.1271	136.0056	141.4740	278.7161	432.7460	521.2650	551.1235	(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													
	801.7289	783.3284	695.9750	568.4117	403.9398	240.9248	136.3129	141.8328	284.6098	476.8867	658.7411	798.2300	(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													
	170.7410	122.2198	87.0492	42.0838	14.2742	0.0000	0.0000	0.0000	0.0000	32.8407	98.9829	183.8473	(98)
Space heating												752.0388	(98)
RHI space heating demand												752	(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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							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		3.2600	
Infiltration rate		0.1630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1386	(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	0.1767	0.1732	0.1697	0.1524	0.1489	0.1316	0.1316	0.1282	0.1386	0.1489	0.1559	0.1628	(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	41.2400	10.2200	31.0200	0.1600	4.9632			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1584	0.8491			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5616			(33)
Party Wall 1			33.8400	0.0000	0.0000			(32)
Party Floor 1			71.1200					(32d)
Party Ceilings 1			71.1200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5768	(36)
Total fabric heat loss (33) + (36) =	27.1384	(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	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	(38)
Heat transfer coeff	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	(39)
Average = Sum(39)m / 12 =												55.3019	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	(40)
HLP (average)												0.7776	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5777	18.8720	19.4742	16.9781	16.2909	14.0578	13.0266	14.9482	15.1268	17.6288	19.2432	20.8969	(46)

CALCULATION OF ENERGY RATINGS 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	14.0915	12.7075	14.0368	13.5476	13.9726	13.4913	13.9220	13.9548	13.5220	14.0103	13.6006	14.0809	(61)
Total heat required for water heating calculated for each month													
	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(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													
	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(64)
								Total per year (kWh/year) = Sum(64)m =				1552.4138	(64)
Heat gains from water heating, kWh/month													
	51.3535	45.0099	46.6771	41.0217	39.6047	34.5343	32.3562	36.6240	36.9115	42.5797	46.0559	49.8417	(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	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	136.3804	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.5274	42.2134	34.3303	25.9902	19.4280	16.4019	17.7229	23.0369	30.9200	39.2601	45.8223	48.8484	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.3535	301.4494	293.6477	277.0387	256.0728	236.3678	223.2036	220.1076	227.9094	244.5184	265.4843	285.1893	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	50.9110	(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)													
	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	-90.9202	(71)
Water heating gains (Table 5)													
	69.0235	66.9790	62.7380	56.9746	53.2321	47.9643	43.4895	49.2258	51.2660	57.2308	63.9666	66.9915	(72)
Total internal gains													
	514.2756	510.0130	490.0872	459.3746	428.1040	400.1052	383.7872	391.7414	409.4666	440.3805	474.6444	500.4003	(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	
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	679.8354	781.1573	835.4769	849.7401	834.8889	791.5803	766.2822	763.1971	770.2670	732.8351	670.8892	643.4592	(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	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	35.7231	
alpha	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	3.3815	
util living area													
	0.8732	0.8194	0.7557	0.6725	0.5638	0.4304	0.3130	0.3279	0.4710	0.6710	0.8212	0.8890	(86)
MIT	20.0485	20.2782	20.5082	20.7182	20.8743	20.9618	20.9900	20.9880	20.9459	20.7595	20.3719	19.9703	(87)
Th 2	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	20.2728	(88)
util rest of house													
	0.8608	0.8033	0.7349	0.6452	0.5283	0.3857	0.2629	0.2779	0.4270	0.6391	0.8025	0.8777	(89)
MIT 2	19.4129	19.6306	19.8468	20.0402	20.1776	20.2485	20.2680	20.2667	20.2368	20.0807	19.7244	19.3381	(90)
Living area fraction									fLA = Living area / (4) =			0.3346	(91)
MIT	19.6256	19.8473	20.0681	20.2671	20.4108	20.4872	20.5096	20.5081	20.4741	20.3079	19.9411	19.5496	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4756	19.6973	19.9181	20.1171	20.2608	20.3372	20.3596	20.3581	20.3241	20.1579	19.7911	19.3996	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8454	0.7894	0.7240	0.6391	0.5277	0.3897	0.2689	0.2838	0.4302	0.6338	0.7889	0.8623	(94)
Useful gains	574.7365	616.6164	604.9260	543.0863	440.5933	308.4808	206.0671	216.5938	331.3324	464.4481	529.2338	554.8584	(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													
	839.2391	818.3190	742.0474	620.3259	473.4267	317.2775	207.9129	218.8904	344.2038	528.5695	701.8434	840.5698	(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													
	196.7900	135.5442	102.0183	55.6125	24.4281	0.0000	0.0000	0.0000	0.0000	47.7063	124.2789	212.5693	(98)
Space heating												898.9476	(98)
Space heating per m2											(98) / (4) =	12.6399	(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	993.3123	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	196.7900	135.5442	102.0183	55.6125	24.4281	0.0000	0.0000	0.0000	0.0000	47.7063	124.2789	212.5693	(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)	217.4475	149.7726	112.7275	61.4503	26.9923	0.0000	0.0000	0.0000	0.0000	52.7141	137.3248	234.8832	(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	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.0467	88.8538	88.5998	88.2517	87.8160	87.3000	87.3000	87.3000	87.3000	88.1294	88.7655	89.1306	(217)
Fuel for water heating, kWh/month	177.3710	155.8976	162.3763	143.6063	139.5858	122.8065	115.4252	130.1372	131.0047	149.2528	159.8467	172.0997	(219)
Water heating fuel used												1759.4099	(219)

Annual totals kWh/year		
Space heating fuel - main system	993.3123	(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)	38.3160	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.3160	(231)
Electricity for lighting (calculated in Appendix L)	335.7397	(232)
Total delivered energy for all uses	3201.7779	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	993.3123	3.4800	34.5673	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1759.4099	3.4800	61.2275	(247)
Mechanical ventilation fans	38.3160	13.1900	5.0539	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	335.7397	13.1900	44.2841	(250)
Additional standing charges			120.0000	(251)
Total energy cost			275.0252	(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] =	0.9948	(257)
SAP value	86.1232	
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	993.3123	0.2160	214.5555	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1759.4099	0.2160	380.0325	(264)
Space and water heating			594.5880	(265)
Pumps and fans	113.3160	0.5190	58.8110	(267)
Energy for lighting	335.7397	0.5190	174.2489	(268)
Total kg/year			827.6479	(272)
CO2 emissions per m2			11.6400	(273)
EI value			90.4491	
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 / 0.8815 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8815 = 0.2450, 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	71.1200 (1b)	x	2.4000 (2b)	=	170.6880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	170.6880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							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		3.2600	
Infiltration rate		0.1630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1386	(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	0.1455	0.1386	0.1386	0.1282	0.1282	0.1143	0.1178	0.1108	0.1143	0.1212	0.1212	0.1316	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:		0.5000	(23a)
Effective ac	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	41.2400	10.2200	31.0200	0.1600	4.9632			(29a)
WT-I-02	7.4800	2.1200	5.3600	0.1584	0.8491			(29a)
Total net area of external elements Aum(A, m2)			48.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.5616			(33)
Party Wall 1			33.8400	0.0000	0.0000			(32)
Party Floor 1			71.1200					(32d)
Party Ceilings 1			71.1200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5768	(36)
Total fabric heat loss (33) + (36) =	27.1384	(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	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	28.1635	(38)
Heat transfer coeff	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	55.3019	(39)
Average = Sum(39)m / 12 =												55.3019	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	0.7776	(40)
HLP (average)												0.7776	(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	2.2730	(42)
Average daily hot water use (litres/day)	88.1839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0023	93.4749	89.9476	86.4202	82.8929	79.3655	79.3655	82.8929	86.4202	89.9476	93.4749	97.0023	(44)
Energy conte	143.8516	125.8135	129.8283	113.1874	108.6060	93.7188	86.8442	99.6550	100.8452	117.5253	128.2881	139.3126	(45)
Energy content (annual)										Total = Sum(45)m =		1387.4760	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5777	18.8720	19.4742	16.9781	16.2909	14.0578	13.0266	14.9482	15.1268	17.6288	19.2432	20.8969	(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     14.0915    12.7075    14.0368    13.5476    13.9726    13.4913    13.9220    13.9548    13.5220    14.0103    13.6006    14.0809 (61)
Total heat required for water heating calculated for each month
              157.9430   138.5210   143.8651   126.7350   122.5787   107.2101   100.7662   113.6098   114.3671   131.5356   141.8887   153.3935 (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
              157.9430   138.5210   143.8651   126.7350   122.5787   107.2101   100.7662   113.6098   114.3671   131.5356   141.8887   153.3935 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1552.4138 (64)
Heat gains from water heating, kWh/month
               51.3535    45.0099    46.6771    41.0217    39.6047    34.5343    32.3562    36.6240    36.9115    42.5797    46.0559    49.8417 (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          136.3804   136.3804   136.3804   136.3804   136.3804   136.3804   136.3804   136.3804   136.3804   136.3804   136.3804   136.3804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               47.5274    42.2134    34.3303    25.9902    19.4280    16.4019    17.7229    23.0369    30.9200    39.2601    45.8223    48.8484 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              298.3535   301.4494   293.6477   277.0387   256.0728   236.3678   223.2036   220.1076   227.9094   244.5184   265.4843   285.1893 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               50.9110    50.9110    50.9110    50.9110    50.9110    50.9110    50.9110    50.9110    50.9110    50.9110    50.9110    50.9110 (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)
              -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202   -90.9202 (71)
Water heating gains (Table 5)
               69.0235    66.9790    62.7380    56.9746    53.2321    47.9643    43.4895    49.2258    51.2660    57.2308    63.9666    66.9915 (72)
Total internal gains
              514.2756   510.0130   490.0872   459.3746   428.1040   400.1052   383.7872   391.7414   409.4666   440.3805   474.6444   500.4003 (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
-----------------------------------------------------------------------------------------------------------
South                                    10.2200          50.9848          0.4500           0.0000          0.7700        180.5490 (78)
-----------------------------------------------------------------------------------------------------------

Solar gains    180.5490   265.3663   333.3669   389.6318   398.2891   411.8829   397.3472   392.0371   377.7133   305.2939   219.0656   154.6394 (83)
Total gains    694.8246   775.3793   823.4540   849.0064   826.3931   811.9880   781.1344   783.7786   787.1799   745.6744   693.7100   655.0397 (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            35.7231    35.7231    35.7231    35.7231    35.7231    35.7231    35.7231    35.7231    35.7231    35.7231    35.7231    35.7231
alpha           3.3815     3.3815     3.3815     3.3815     3.3815     3.3815     3.3815     3.3815     3.3815     3.3815     3.3815     3.3815
util living area
                0.8530     0.8065     0.7356     0.6348     0.5032     0.3346     0.2185     0.2246     0.3956     0.6186     0.7853     0.8700 (86)

MIT            20.1733    20.3474    20.5779    20.7841    20.9234    20.9861    20.9977    20.9974    20.9731    20.8312    20.4978    20.1075 (87)
Th 2           20.2728    20.2728    20.2728    20.2728    20.2728    20.2728    20.2728    20.2728    20.2728    20.2728    20.2728    20.2728 (88)
util rest of house
                0.8385     0.7890     0.7127     0.6047     0.4638     0.2878     0.1677     0.1741     0.3493     0.5829     0.7633     0.8566 (89)
MIT 2          19.5331    19.6969    19.9123    20.0991    20.2183    20.2653    20.2720    20.2719    20.2567    20.1430    19.8424    19.4710 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3346 (91)
MIT            19.7473    19.9146    20.1350    20.3283    20.4543    20.5065    20.5149    20.5147    20.4965    20.3733    20.0617    19.6840 (92)
Temperature adjustment                                                                                                          -0.1500
adjusted MIT   19.5973    19.7646    19.9850    20.1783    20.3043    20.3565    20.3649    20.3647    20.3465    20.2233    19.9117    19.5340 (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     0.8236     0.7757     0.7031     0.6007     0.4656     0.2933     0.1741     0.1805     0.3541     0.5803     0.7514     0.8414 (94)
Useful gains   572.2383   601.4536   578.9734   509.9620   384.7541   238.1271   136.0056   141.4740   278.7161   432.7460   521.2650   551.1235 (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
              801.7289   783.3284   695.9750   568.4117   403.9398   240.9248   136.3129   141.8328   284.6098   476.8867   658.7411   798.2300 (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
              170.7410   122.2198    87.0492    42.0838    14.2742     0.0000     0.0000     0.0000     0.0000    32.8407    98.9829   183.8473 (98)
Space heating                                                                                                                     752.0388 (98)
Space heating per m2                                                                                                 (98) / (4) =    10.5742 (99)


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8c. Space cooling requirement
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Not applicable
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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	830.9821	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	170.7410	122.2198	87.0492	42.0838	14.2742	0.0000	0.0000	0.0000	0.0000	32.8407	98.9829	183.8473	(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)	188.6641	135.0495	96.1869	46.5014	15.7726	0.0000	0.0000	0.0000	0.0000	36.2880	109.3733	203.1461	(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	157.9430	138.5210	143.8651	126.7350	122.5787	107.2101	100.7662	113.6098	114.3671	131.5356	141.8887	153.3935	(64)
Efficiency of water heater (217)m	88.9335	88.7713	88.4794	88.0763	87.6232	87.3000	87.3000	87.3000	87.3000	87.9211	88.5872	89.0159	(217)
Fuel for water heating, kWh/month	177.5967	156.0426	162.5973	143.8922	139.8930	122.8065	115.4252	130.1372	131.0047	149.6064	160.1684	172.3215	(219)

Water heating fuel used	1761.4917	(219)
Annual totals kWh/year		
Space heating fuel - main system	830.9821	(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)	38.3160	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.3160	(231)
Electricity for lighting (calculated in Appendix L)	335.7397	(232)
Total delivered energy for all uses	3041.5295	(238)

10a. Fuel costs - using BEDF prices (476)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	830.9821	3.8700	32.1590	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1761.4917	3.8700	68.1697	(247)
Mechanical ventilation fans	38.3160	18.9000	7.2417	(249)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Energy for lighting	335.7397	18.9000	63.4548	(250)
Additional standing charges			93.0000	(251)
Total energy cost			278.2003	(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	830.9821	0.2160	179.4921	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1761.4917	0.2160	380.4822	(264)
Space and water heating			559.9743	(265)
Pumps and fans	113.3160	0.5190	58.8110	(267)
Energy for lighting	335.7397	0.5190	174.2489	(268)
Total kg/year			793.0343	(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	830.9821	1.2200	1013.7982	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1761.4917	1.2200	2149.0198	(264)
Space and water heating			3162.8180	(265)
Pumps and fans	113.3160	3.0700	347.8802	(267)
Energy for lighting	335.7397	3.0700	1030.7208	(268)
Primary energy kWh/year			4541.4191	(272)
Primary energy kWh/m2/year			63.8557	(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)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(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 476 TEST (01 Apr 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	£85	£85	£0
Mains gas	£193	£193	£0
Space heating	£147	£147	£0
Water heating	£68	£68	£0
Lighting	£63	£63	£0
Total cost of fuels	£278	£278	£0
Total cost of uses	£278	£278	£0
Delivered energy	43 kWh/m²	43 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	64 kWh/m²	64 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	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	337.96	(P1)
Transmission heat loss coefficient	27.14	(37)
Summer heat loss coefficient	365.10	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
South	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
South	10.2200	112.2060	0.4500	0.0000	0.9000	464.4318
total:						464.4318

	Jun	Jul	Aug	
Solar gains	481	464	458	(P4)
Internal gains	397	381	389	
Total summer gains	879	845	847	(P5)
Summer gain/loss ratio	2.41	2.32	2.32	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.71	21.52	21.42	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight