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

Property Reference	SECPMW025q_103_As_Built	**Issued on Date**	03/12/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	85 B	**DER**	15.69	**TER**	16.72
Environmental	89 B	**% DER<TER**	6.17		
CO_2 Emissions (t/year)	0.90	**DFEE**	35.96	**TFEE**	39.11
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.05		

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

Regs Region: England
Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r19

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 70 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) 16.72 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.69 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)39.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.29 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.24 (max. 2.00)	1.30 (max. 3.30)	OK

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

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3 Air permeability
Air permeability at 50 pascals: 3.24 (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): Medium OK
Based on:
Overshading: Average
Windows facing East: 9.04 m², No overhang
Air change rate: 3.00 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 3.2 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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		3.2400	
Infiltration rate		0.1620	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1256	(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	0.1601	0.1569	0.1538	0.1381	0.1350	0.1193	0.1193	0.1161	0.1256	0.1350	0.1412	0.1475	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711			(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184			(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4741			(33)
Party Wall 1			11.5200	0.0000	0.0000			(32)
Party Floor 1			70.2400					(32d)
Party Ceilings 1			70.2400					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6840	(36)
Total fabric heat loss					(33) + (36) =		37.1581	(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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	(38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	(39)
Average = Sum(39)m / 12 =												64.9731	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	(40)
HLP (average)												0.9250	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)

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

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772	(61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
								Total per year (kWh/year) = Sum(64)m =				1544.5074	(64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	345.5702	343.4351	330.8470	310.7192	290.4325	270.8998	258.2562	264.0621	274.4619	294.7900	318.0529	335.3555	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	19.6403	0.4500	0.0000	0.7700	61.5204	(76)

Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)
Total gains	407.0906	463.7820	529.0413	599.7736	644.6796	633.5347	603.4994	560.6209	504.9700	437.5918	394.7616	385.9469	(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	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	
util living area	0.9983	0.9958	0.9860	0.9451	0.8280	0.6374	0.4709	0.5273	0.8016	0.9728	0.9961	0.9987	(86)
MIT	20.0538	20.1854	20.4138	20.6942	20.9018	20.9832	20.9976	20.9955	20.9393	20.6514	20.2891	20.0156	(87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	(88)
util rest of house	0.9977	0.9944	0.9813	0.9269	0.7801	0.5604	0.3811	0.4325	0.7318	0.9603	0.9945	0.9983	(89)
MIT 2	19.2771	19.4082	19.6340	19.9026	20.0823	20.1388	20.1457	20.1450	20.1138	19.8674	19.5119	19.2390	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.5237	19.6549	19.8815	20.1539	20.3425	20.4069	20.4162	20.4150	20.3759	20.1163	19.7586	19.4855	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3737	19.5049	19.7315	20.0039	20.1925	20.2569	20.2662	20.2650	20.2259	19.9663	19.6086	19.3355	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9930	0.9784	0.9234	0.7829	0.5707	0.3938	0.4459	0.7389	0.9570	0.9932	0.9978	(94)
Useful gains	405.8665	460.5401	517.6367	553.8065	504.7268	361.5467	237.6581	250.0029	373.1281	418.7568	392.0879	385.0928	(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	979.3848	948.9289	859.6951	721.4578	551.7839	367.5472	238.2016	251.1224	398.0162	608.5580	812.7236	983.4027	(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	426.6976	328.1973	254.4914	120.7090	35.0105	0.0000	0.0000	0.0000	0.0000	141.2121	302.8577	445.1426	(98)
Space heating												2054.3181	(98)
Space heating per m2											(98) / (4) =	29.2471	(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	2269.9648	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	426.6976	328.1973	254.4914	120.7090	35.0105	0.0000	0.0000	0.0000	0.0000	141.2121	302.8577	445.1426	(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)													
	471.4891	362.6489	281.2060	133.3801	38.6856	0.0000	0.0000	0.0000	0.0000	156.0355	334.6494	491.8702	(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													
	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6159	89.5295	89.3215	88.8363	87.9940	87.3000	87.3000	87.3000	87.3000	88.9321	89.4575	89.6610	(217)
Fuel for water heating, kWh/month													
	175.3293	153.9201	160.2361	141.9352	138.6004	122.1950	114.8586	129.4869	130.3466	147.1526	157.7927	170.1959	(219)
Water heating fuel used												1742.0495	(219)
Annual totals kWh/year													
Space heating fuel - main system												2269.9648	(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)	37.8419	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.8419	(231)
Electricity for lighting (calculated in Appendix L)	340.4401	(232)
Total delivered energy for all uses	4465.2964	(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	2269.9648	0.2160	490.3124	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1742.0495	0.2160	376.2827	(264)
Space and water heating			866.5951	(265)
Pumps and fans	112.8419	0.5190	58.5650	(267)
Energy for lighting	340.4401	0.5190	176.6884	(268)
Total CO2, kg/year			1101.8485	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6900	(273)

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

DER		15.6900	ZC1
Total Floor Area	TFA	70.2400	
Assumed number of occupants	N	2.2519	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6921	ZC2
CO2 emissions from cooking, equation (L16)		2.4636	ZC3
Total CO2 emissions		34.8458	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		34.8458	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	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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) =	0.1780	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4280	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(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)			9.0400	1.3258	11.9848			(27)
WT-E-01	35.5700	9.0400	26.5300	0.1800	4.7754			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.1800	4.6206			(29a)
WT-I-11	12.7200		12.7200	0.1800	2.2896			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4795	(36)
Total fabric heat loss						(33) + (36) =	32.2699	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.7891	32.5960	32.4066	31.5174	31.3510	30.5765	30.5765	30.4331	30.8748	31.3510	31.6876	32.0395	(38)
Heat transfer coeff	65.0591	64.8659	64.6766	63.7873	63.6210	62.8465	62.8465	62.7030	63.1448	63.6210	63.9575	64.3094	(39)
Average = Sum(39)m / 12 =												63.7865	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9262	0.9235	0.9208	0.9081	0.9058	0.8947	0.8947	0.8927	0.8990	0.9058	0.9106	0.9156	(40)
HLP (average)												0.9081	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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Combi loss	49.1508	42.7799	45.5762	42.3764	42.0016	38.9171	40.2143	42.0016	42.3764	45.5762	45.8357	49.1508	(61)
Total heat required for water heating calculated for each month													
	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729	(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													
	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729	(64)
Total per year (kWh/year) = Sum(64)m =												1905.5601	(64)
Heat gains from water heating, kWh/month													
	59.8470	52.2906	54.3170	48.0154	46.4070	40.7139	38.7654	43.4477	43.9349	50.2495	53.8727	58.3463	(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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(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)													
	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)													
	80.4394	77.8134	73.0067	66.6880	62.3750	56.5471	52.1041	58.3974	61.0206	67.5396	74.8232	78.4224	(72)
Total internal gains													
	357.3522	354.6239	341.4460	320.7301	299.8517	279.7288	267.0916	273.4872	284.4816	305.3978	329.2468	347.1410	(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	
East	9.0400	19.6403	0.6300	0.7000	0.7700	54.2610	(76)

Solar gains	54.2610	106.1460	174.8073	254.9460	312.4459	319.8440	304.5045	261.5649	203.3081	125.9511	67.6571	44.6216	(83)
Total gains	411.6132	460.7699	516.2533	575.6761	612.2976	599.5728	571.5961	535.0520	487.7897	431.3490	396.9038	391.7626	(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	74.9746	75.1979	75.4180	76.4694	76.6693	77.6142	77.6142	77.7917	77.2475	76.6693	76.2659	75.8486	
alpha	5.9983	6.0132	6.0279	6.0980	6.1113	6.1743	6.1743	6.1861	6.1498	6.1113	6.0844	6.0566	
util living area													
	0.9982	0.9959	0.9875	0.9514	0.8442	0.6509	0.4809	0.5336	0.8072	0.9732	0.9959	0.9986	(86)
MIT	20.0582	20.1835	20.4028	20.6865	20.8954	20.9833	20.9977	20.9959	20.9412	20.6616	20.3097	20.0374	(87)
Th 2	20.1453	20.1476	20.1499	20.1606	20.1626	20.1720	20.1720	20.1737	20.1684	20.1626	20.1585	20.1543	(88)
util rest of house													
	0.9976	0.9946	0.9833	0.9350	0.7986	0.5751	0.3920	0.4407	0.7391	0.9610	0.9943	0.9982	(89)
MIT 2	18.8789	19.0634	19.3830	19.7918	20.0614	20.1609	20.1711	20.1720	20.1219	19.7653	19.2564	18.8554	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.2534	19.4190	19.7068	20.0759	20.3261	20.4220	20.4335	20.4335	20.3820	20.0499	19.5908	19.2306	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2534	19.4190	19.7068	20.0759	20.3261	20.4220	20.4335	20.4335	20.3820	20.0499	19.5908	19.2306	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9930	0.9804	0.9331	0.8083	0.5986	0.4203	0.4703	0.7580	0.9590	0.9928	0.9975	(94)
Useful gains	410.2456	457.5512	506.1434	537.1350	494.9160	358.9331	240.2507	251.6152	369.7639	413.6607	394.0525	390.7797	(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													
	972.8513	941.7894	854.1707	712.8781	548.8039	365.8924	240.9244	252.9152	396.6757	601.2101	798.8836	966.6119	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	418.5786	325.4081	258.9323	126.5351	40.0926	0.0000	0.0000	0.0000	0.0000	139.5368	291.4784	428.4192	(98)
Space heating												2028.9810	(98)
Space heating per m2											(98) / (4) =	28.8864	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)

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Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2172.3565	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.5786	325.4081	258.9323	126.5351	40.0926	0.0000	0.0000	0.0000	0.0000	139.5368	291.4784	428.4192	(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)	448.1570	348.4026	277.2294	135.4765	42.9257	0.0000	0.0000	0.0000	0.0000	149.3970	312.0754	458.6929	(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	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.9584	86.6892	86.0405	84.5467	82.2380	80.3000	80.3000	80.3000	80.3000	84.6713	86.3490	87.0642	(217)
Fuel for water heating, kWh/month	221.0094	193.6568	203.0064	183.2379	182.3871	164.5131	157.6161	175.7050	177.6455	191.8415	200.8082	215.5569	(219)
Water heating fuel used												2266.9839	(219)

Annual totals kWh/year		
Space heating fuel - main system	2172.3565	(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)	340.4401	(232)
Total delivered energy for all uses	4854.7806	(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	2172.3565	0.2160	469.2290	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2266.9839	0.2160	489.6685	(264)
Space and water heating			958.8975	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	340.4401	0.5190	176.6884	(268)
Total CO2, kg/m2/year			1174.5110	(272)
Emissions per m2 for space and water heating			13.6517	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5155	(272b)
Emissions per m2 for pumps and fans			0.5542	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6517 * 1.00) + 2.5155 + 0.5542, rounded to 2 d.p.			16.7200	(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	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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) =	0.1780	(8)
Pressure test		Yes	
Measured/design AP50		3.2400	
Infiltration rate		0.3400	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2635	(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	0.3359	0.3293	0.3228	0.2898	0.2832	0.2503	0.2503	0.2437	0.2635	0.2832	0.2964	0.3096	(22b)
Effective ac	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184			(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4741			(33)
Party Wall 1			11.5200	0.0000	0.0000			(32)
Party Floor 1			70.2400					(32d)
Party Ceilings 1			70.2400					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.6840	(36)
Total fabric heat loss (33) + (36) =	37.1581	(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	30.9538	30.8319	30.7125	30.1513	30.0463	29.5576	29.5576	29.4671	29.7459	30.0463	30.2587	30.4808	(38)
Heat transfer coeff	68.1119	67.9900	67.8706	67.3094	67.2044	66.7157	66.7157	66.6252	66.9040	67.2044	67.4168	67.6389	(39)
Average = Sum(39)m / 12 =												67.3089	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9697	0.9680	0.9663	0.9583	0.9568	0.9498	0.9498	0.9485	0.9525	0.9568	0.9598	0.9630	(40)
HLP (average)												0.9583	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.3950	26.5837	27.4320	23.9159	22.9478	19.8022	18.3497	21.0565	21.3080	24.8324	27.1065	29.4359	(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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(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)													
	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)													
	40.8535	39.5590	36.8709	33.2165	30.8439	27.5031	24.6635	28.3018	29.5945	33.3769	37.6480	39.5644	(72)
Total internal gains													
	314.7663	313.3696	302.3102	284.2586	265.3205	247.6848	236.6511	240.3915	250.0554	268.2351	289.0716	305.2830	(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	
East	9.0400	19.6403	0.4500	0.0000	0.7700	61.5204	(76)

Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)
Total gains	376.2866	433.7165	500.5044	573.3130	619.5676	610.3197	581.8943	536.9504	480.5635	411.0368	365.7802	355.8744	(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	71.6141	71.7425	71.8688	72.4680	72.5812	73.1129	73.1129	73.2122	72.9072	72.5812	72.3525	72.1150	
alpha	5.7743	5.7828	5.7913	5.8312	5.8387	5.8742	5.8742	5.8808	5.8605	5.8387	5.8235	5.8077	
util living area													
	0.9989	0.9971	0.9901	0.9580	0.8575	0.6714	0.4999	0.5615	0.8365	0.9809	0.9975	0.9992	(86)
MIT	19.9471	20.0843	20.3241	20.6325	20.8701	20.9761	20.9963	20.9931	20.9173	20.5902	20.2074	19.9193	(87)
Th 2	20.1087	20.1101	20.1115	20.1182	20.1195	20.1254	20.1254	20.1264	20.1231	20.1195	20.1170	20.1143	(88)
util rest of house													
	0.9985	0.9962	0.9866	0.9430	0.8124	0.5912	0.4030	0.4597	0.7697	0.9716	0.9964	0.9989	(89)
MIT 2	19.1395	19.2775	19.5167	19.8211	20.0329	20.1145	20.1244	20.1244	20.0772	19.7864	19.4063	19.1164	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.3959	19.5336	19.7730	20.0787	20.2987	20.3881	20.4012	20.4002	20.3439	20.0416	19.6606	19.3713	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3959	19.5336	19.7730	20.0787	20.2987	20.3881	20.4012	20.4002	20.3439	20.0416	19.6606	19.3713	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9953	0.9849	0.9422	0.8224	0.6162	0.4339	0.4923	0.7883	0.9706	0.9957	0.9986	(94)
Useful gains	375.5667	431.6987	492.9690	540.1809	509.5567	376.0841	252.5096	264.3164	378.8360	398.9419	364.2099	355.3782	(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													
	1028.2105	994.9409	900.8479	752.4340	577.8700	386.1557	253.6016	266.5161	417.7450	634.5149	846.7986	1026.1680	(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													
	485.5669	378.4987	303.4619	152.8222	50.8251	0.0000	0.0000	0.0000	0.0000	175.2663	347.4639	499.0675	(98)
Space heating												2392.9726	(98)
Space heating per m2											(98) / (4) =	34.0685	(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	627.1276	493.6962	506.3515	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9357	0.9712	0.9569	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	586.7831	479.4667	484.5524	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	797.7512	762.8934	711.9518	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	151.8970	210.8695	169.1852	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												531.9517	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                                    fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                 0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                 0.0000     0.0000     0.0000     0.0000     0.0000    37.9743    52.7174    42.2963     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                            132.9879 (107)
Space cooling per m2                                                                                                                       1.8933 (108)
Energy for space heating                                                                                                                  34.0685 (99)
Energy for space cooling                                                                                                                   1.8933 (108)
Total                                                                                                                                     35.9619 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                     36.0 (109)


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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	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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) =	0.1780	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4280	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(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)			9.0400	1.3258	11.9848			(27)
WT-E-01	35.5700	9.0400	26.5300	0.1800	4.7754			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.1800	4.6206			(29a)
WT-I-11	12.7200		12.7200	0.1800	2.2896			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.7904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4795	(36)
Total fabric heat loss						(33) + (36) =	32.2699	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.7891	32.5960	32.4066	31.5174	31.3510	30.5765	30.5765	30.4331	30.8748	31.3510	31.6876	32.0395	(38)
Heat transfer coeff	65.0591	64.8659	64.6766	63.7873	63.6210	62.8465	62.8465	62.7030	63.1448	63.6210	63.9575	64.3094	(39)
Average = Sum(39)m / 12 =												63.7865	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9262	0.9235	0.9208	0.9081	0.9058	0.8947	0.8947	0.8927	0.8990	0.9058	0.9106	0.9156	(40)
HLP (average)												0.9081	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.3950	26.5837	27.4320	23.9159	22.9478	19.8022	18.3497	21.0565	21.3080	24.8324	27.1065	29.4359	(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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.2771	17.1218	13.9244	10.5416	7.8800	6.6526	7.1884	9.3438	12.5412	15.9239	18.5855	19.8129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(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)													
	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)													
	40.8535	39.5590	36.8709	33.2165	30.8439	27.5031	24.6635	28.3018	29.5945	33.3769	37.6480	39.5644	(72)
Total internal gains													
	314.7663	313.3696	302.3102	284.2586	265.3205	247.6848	236.6511	240.3915	250.0554	268.2351	289.0716	305.2830	(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	
East	9.0400	19.6403	0.6300	0.7000	0.7700	54.2610	(76)

Solar gains	54.2610	106.1460	174.8073	254.9460	312.4459	319.8440	304.5045	261.5649	203.3081	125.9511	67.6571	44.6216	(83)
Total gains	369.0272	419.5155	477.1175	539.2046	577.7665	567.5288	541.1556	501.9564	453.3636	394.1862	356.7286	349.9046	(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	74.9746	75.1979	75.4180	76.4694	76.6693	77.6142	77.6142	77.7917	77.2475	76.6693	76.2659	75.8486	
alpha	5.9983	6.0132	6.0279	6.0980	6.1113	6.1743	6.1743	6.1861	6.1498	6.1113	6.0844	6.0566	
util living area													
	0.9990	0.9975	0.9916	0.9633	0.8694	0.6818	0.5070	0.5665	0.8425	0.9825	0.9977	0.9993	(86)
MIT	19.9994	20.1272	20.3516	20.6470	20.8749	20.9786	20.9970	20.9943	20.9247	20.6161	20.2547	19.9794	(87)
Th 2	20.1453	20.1476	20.1499	20.1606	20.1626	20.1720	20.1720	20.1737	20.1684	20.1626	20.1585	20.1543	(88)
util rest of house													
	0.9986	0.9967	0.9886	0.9501	0.8273	0.6046	0.4138	0.4690	0.7787	0.9740	0.9968	0.9990	(89)
MIT 2	19.2220	19.3514	19.5762	19.8725	20.0781	20.1621	20.1712	20.1720	20.1261	19.8485	19.4880	19.2095	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.4688	19.5977	19.8223	20.1184	20.3311	20.4213	20.4333	20.4331	20.3797	20.0922	19.7314	19.4539	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4688	19.5977	19.8223	20.1184	20.3311	20.4213	20.4333	20.4331	20.3797	20.0922	19.7314	19.4539	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9960	0.9871	0.9493	0.8366	0.6287	0.4435	0.5002	0.7966	0.9731	0.9961	0.9987	(94)
Useful gains	368.3939	417.8232	470.9837	511.8767	483.3652	356.8210	240.0059	251.0676	361.1318	383.5795	355.3462	349.4670	(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													
	986.8699	953.3773	861.6440	715.5896	549.1170	365.8504	240.9122	252.8869	396.5276	603.9034	807.8742	980.9697	(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													
	460.1461	359.8923	290.6512	146.6732	48.9193	0.0000	0.0000	0.0000	0.0000	163.9210	325.8202	469.8381	(98)
Space heating												2265.8614	(98)
Space heating per m2											(98) / (4) =	32.2588	(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	590.7566	465.0637	476.5430	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9399	0.9743	0.9619	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	555.2624	453.1170	458.3670	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	747.7359	715.2767	671.0498	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	138.5809	195.0469	158.2359	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												491.8637	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.6452	48.7617	39.5590	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												122.9659	(107)
Space cooling per m2												1.7507	(108)
Energy for space heating												32.2588	(99)
Energy for space cooling												1.7507	(108)
Total												34.0095	(109)
Target Fabric Energy Efficiency (TFEE)												39.1	(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	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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		3.2400	
Infiltration rate		0.1620	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1256	(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	0.1318	0.1256	0.1256	0.1161	0.1161	0.1036	0.1067	0.1004	0.1036	0.1099	0.1099	0.1193	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184			(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4741			(33)
Party Wall 1			11.5200	0.0000	0.0000			(32)
Party Floor 1			70.2400					(32d)
Party Ceilings 1			70.2400					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6840	(36)
Total fabric heat loss						(33) + (36) =	37.1581	(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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	(38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	(39)
Average = Sum(39)m / 12 =												64.9731	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	(40)
HLP (average)												0.9250	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)

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

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772	(61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
								Total per year (kWh/year) = Sum(64)m =				1544.5074	(64)
RHI water heating demand												1545	(64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.1928	42.8044	34.8109	26.3541	19.7000	16.6316	17.9710	23.3594	31.3529	39.8097	46.4638	49.5323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	510.9609	506.6040	486.6715	456.0445	424.9173	397.1072	380.9674	388.9951	406.7394	437.5666	471.6701	497.2500	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	22.3313	0.4500	0.0000	0.7700	69.9497	(76)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	69.9497	123.0867	199.8710	299.5493	356.9257	390.7204	368.0744	323.8182	251.6920	155.8605	89.3522	56.9651	(83)
Total gains	580.9106	629.6906	686.5425	755.5939	781.8430	787.8276	749.0419	712.8133	658.4313	593.4271	561.0223	554.2151	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	
util living area	0.9860	0.9761	0.9409	0.8365	0.6445	0.4112	0.2688	0.2916	0.5636	0.8693	0.9695	0.9888	(86)
MIT	20.3582	20.4619	20.6687	20.8757	20.9778	20.9987	20.9999	20.9999	20.9920	20.8677	20.5807	20.3238	(87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	(88)
util rest of house	0.9817	0.9691	0.9242	0.7978	0.5830	0.3416	0.1948	0.2138	0.4847	0.8273	0.9590	0.9854	(89)
MIT 2	19.5784	19.6794	19.8762	20.0585	20.1345	20.1459	20.1463	20.1463	20.1432	20.0566	19.7961	19.5447	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.8260	19.9278	20.1278	20.3180	20.4022	20.4166	20.4173	20.4173	20.4127	20.3141	20.0452	19.7920	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6760	19.7778	19.9778	20.1680	20.2522	20.2666	20.2673	20.2673	20.2627	20.1641	19.8952	19.6420	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9654	0.9203	0.7988	0.5909	0.3514	0.2053	0.2249	0.4957	0.8282	0.9552	0.9828	(94)
Useful gains	568.5752	607.8819	631.8432	603.5984	461.9848	276.8777	153.8016	160.2907	326.3663	491.4988	535.8955	544.6799	(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	947.0470	921.1766	817.2205	667.1429	471.1993	277.2173	153.8107	160.3067	328.9364	556.4349	772.8687	944.8420	(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	281.5830	210.5340	137.9207	45.7520	6.8556	0.0000	0.0000	0.0000	0.0000	48.3125	170.6207	297.7206	(98)
Space heating												1199.2991	(98)
RHI space heating demand												1199	(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	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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		3.2400	
Infiltration rate		0.1620	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1256	(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	0.1601	0.1569	0.1538	0.1381	0.1350	0.1193	0.1193	0.1161	0.1256	0.1350	0.1412	0.1475	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)
Effective ac	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711			(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184			(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4741			(33)
Party Wall 1			11.5200	0.0000	0.0000			(32)
Party Floor 1			70.2400					(32d)
Party Ceilings 1			70.2400					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6840	(36)
Total fabric heat loss					(33) + (36) =		37.1581	(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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	(38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	(39)
Average = Sum(39)m / 12 =												64.9731	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	(40)
HLP (average)												0.9250	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772	(61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
								Total per year (kWh/year) = Sum(64)m =				1544.5074	(64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.1928	42.8044	34.8109	26.3541	19.7000	16.6316	17.9710	23.3594	31.3529	39.8097	46.4638	49.5323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	510.9609	506.6040	486.6715	456.0445	424.9173	397.1072	380.9674	388.9951	406.7394	437.5666	471.6701	497.2500	(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	
East	9.0400	19.6403	0.4500	0.0000	0.7700	61.5204	(76)

Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)
Total gains	572.4813	626.9509	684.8657	745.0990	779.1644	759.7421	726.2107	685.5539	637.2474	580.3684	548.3787	547.8414	(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	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	
util living area	0.9897	0.9809	0.9549	0.8792	0.7300	0.5406	0.3928	0.4343	0.6759	0.9136	0.9797	0.9920	(86)
MIT	20.2772	20.3990	20.5983	20.8172	20.9506	20.9929	20.9991	20.9984	20.9755	20.7972	20.4899	20.2359	(87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	(88)
util rest of house	0.9867	0.9755	0.9423	0.8487	0.6766	0.4715	0.3171	0.3546	0.6031	0.8841	0.9729	0.9896	(89)
MIT 2	19.4984	19.6178	19.8098	20.0092	20.1161	20.1433	20.1461	20.1459	20.1344	19.9969	19.7083	19.4576	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.7456	19.8658	20.0602	20.2658	20.3811	20.4130	20.4169	20.4165	20.4014	20.2510	19.9565	19.7047	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5956	19.7158	19.9102	20.1158	20.2311	20.2630	20.2669	20.2665	20.2514	20.1010	19.8065	19.5547	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9721	0.9381	0.8475	0.6821	0.4811	0.3278	0.3659	0.6124	0.8823	0.9695	0.9875	(94)
Useful gains	563.4475	609.4316	642.5012	631.5038	531.4910	365.4883	238.0508	250.8359	390.2696	512.0506	531.6434	540.9855	(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	993.8052	962.6322	871.3010	728.7228	554.2895	367.9432	238.2494	251.2198	399.6770	617.3081	825.5782	997.6440	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	320.1862	237.3508	170.2270	69.9977	16.9620	0.0000	0.0000	0.0000	0.0000	78.3116	211.6331	339.7540	(98)
Space heating												1444.4224	(98)
Space heating per m2											(98) / (4) =	20.5641	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1596.0468	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	320.1862	237.3508	170.2270	69.9977	16.9620	0.0000	0.0000	0.0000	0.0000	78.3116	211.6331	339.7540	(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)													
	353.7969	262.2661	188.0961	77.3455	18.7426	0.0000	0.0000	0.0000	0.0000	86.5321	233.8487	375.4187	(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													
	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.4210	89.2977	89.0098	88.4160	87.6785	87.3000	87.3000	87.3000	87.3000	88.4712	89.1919	89.4834	(217)
Fuel for water heating, kWh/month													
	175.7115	154.3198	160.7973	142.6100	139.0990	122.1950	114.8586	129.4869	130.3466	147.9193	158.2627	170.5337	(219)
Water heating fuel used												1746.1403	(219)
Annual totals kWh/year													
Space heating fuel - main system												1596.0468	(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)	37.8419	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.8419	(231)
Electricity for lighting (calculated in Appendix L)	340.4401	(232)
Total delivered energy for all uses	3795.4692	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1596.0468	3.4800	55.5424	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1746.1403	3.4800	60.7657	(247)
Mechanical ventilation fans	37.8419	13.1900	4.9914	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	340.4401	13.1900	44.9041	(250)
Additional standing charges			120.0000	(251)
Total energy cost			296.0960	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0791	(257)
SAP value		84.9460	
SAP rating (Section 12)		85	(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	1596.0468	0.2160	344.7461	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1746.1403	0.2160	377.1663	(264)
Space and water heating			721.9124	(265)
Pumps and fans	112.8419	0.5190	58.5650	(267)
Energy for lighting	340.4401	0.5190	176.6884	(268)
Total kg/year			957.1658	(272)
CO2 emissions per m2			13.6300	(273)
EI value			88.8702	
EI rating			89	(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 / 0.8835 = 3.939, stars = 4
Water heating environmental impact	0.216 / 0.8835 = 0.2445, 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	70.2400 (1b)	x	2.4000 (2b)	=	168.5760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.5760	(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			3.2400	
Infiltration rate			0.1620	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1256	(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	0.1318	0.1256	0.1256	0.1161	0.1161	0.1036	0.1067	0.1004	0.1036	0.1099	0.1099	0.1193	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	35.5700	9.0400	26.5300	0.2000	5.3060			(29a)
WT-I-01	27.7900	2.1200	25.6700	0.2890	7.4184			(29a)
WT-I-11	12.7200		12.7200	0.2719	3.4586			(29a)
Total net area of external elements Aum(A, m2)			76.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4741			(33)
Party Wall 1			11.5200	0.0000	0.0000			(32)
Party Floor 1			70.2400					(32d)
Party Ceilings 1			70.2400					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6840	(36)
Total fabric heat loss					(33) + (36) =		37.1581	(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	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	27.8150	(38)
Heat transfer coeff	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	64.9731	(39)
Average = Sum(39)m / 12 =												64.9731	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250	(40)
HLP (average)												0.9250	(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	2.2519	(42)
Average daily hot water use (litres/day)	87.6835	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Energy content (annual)										Total = Sum(45)m =		1379.6031	(45)

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

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

	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772	(61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
								Total per year (kWh/year) = Sum(64)m =				1544.5074	(64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.1928	42.8044	34.8109	26.3541	19.7000	16.6316	17.9710	23.3594	31.3529	39.8097	46.4638	49.5323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	510.9609	506.6040	486.6715	456.0445	424.9173	397.1072	380.9674	388.9951	406.7394	437.5666	471.6701	497.2500	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	22.3313	0.4500	0.0000	0.7700	69.9497	(76)

Solar gains	69.9497	123.0867	199.8710	299.5493	356.9257	390.7204	368.0744	323.8182	251.6920	155.8605	89.3522	56.9651	(83)
Total gains	580.9106	629.6906	686.5425	755.5939	781.8430	787.8276	749.0419	712.8133	658.4313	593.4271	561.0223	554.2151	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	75.0738	
alpha	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	6.0049	
util living area	0.9860	0.9761	0.9409	0.8365	0.6445	0.4112	0.2688	0.2916	0.5636	0.8693	0.9695	0.9888	(86)
MIT	20.3582	20.4619	20.6687	20.8757	20.9778	20.9987	20.9999	20.9999	20.9920	20.8677	20.5807	20.3238	(87)
Th 2	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	20.1463	(88)
util rest of house	0.9817	0.9691	0.9242	0.7978	0.5830	0.3416	0.1948	0.2138	0.4847	0.8273	0.9590	0.9854	(89)
MIT 2	19.5784	19.6794	19.8762	20.0585	20.1345	20.1459	20.1463	20.1463	20.1432	20.0566	19.7961	19.5447	(90)
Living area fraction									fLA = Living area / (4) =			0.3175	(91)
MIT	19.8260	19.9278	20.1278	20.3180	20.4022	20.4166	20.4173	20.4173	20.4127	20.3141	20.0452	19.7920	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6760	19.7778	19.9778	20.1680	20.2522	20.2666	20.2673	20.2673	20.2627	20.1641	19.8952	19.6420	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9654	0.9203	0.7988	0.5909	0.3514	0.2053	0.2249	0.4957	0.8282	0.9552	0.9828	(94)
Useful gains	568.5752	607.8819	631.8432	603.5984	461.9848	276.8777	153.8016	160.2907	326.3663	491.4988	535.8955	544.6799	(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	947.0470	921.1766	817.2205	667.1429	471.1993	277.2173	153.8107	160.3067	328.9364	556.4349	772.8687	944.8420	(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	281.5830	210.5340	137.9207	45.7520	6.8556	0.0000	0.0000	0.0000	0.0000	48.3125	170.6207	297.7206	(98)
Space heating												1199.2991	(98)
Space heating per m2											(98) / (4) =	17.0743	(99)

8c. Space cooling requirement

Not applicable

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

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1325.1923	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	281.5830	210.5340	137.9207	45.7520	6.8556	0.0000	0.0000	0.0000	0.0000	48.3125	170.6207	297.7206	(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)													
	311.1414	232.6343	152.3985	50.5547	7.5752	0.0000	0.0000	0.0000	0.0000	53.3840	188.5311	328.9730	(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													
	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.3273	89.2064	88.8416	88.1297	87.4646	87.3000	87.3000	87.3000	87.3000	88.1403	89.0226	89.3897	(217)
Fuel for water heating, kWh/month													
	175.8958	154.4776	161.1016	143.0734	139.4392	122.1950	114.8586	129.4869	130.3466	148.4745	158.5637	170.7125	(219)
Water heating fuel used												1748.6254	(219)

Annual totals kWh/year		
Space heating fuel - main system	1325.1923	(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)	37.8419	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.8419	(231)
Electricity for lighting (calculated in Appendix L)	340.4401	(232)
Total delivered energy for all uses	3527.0998	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1325.1923	3.7400	49.5622	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1748.6254	3.7400	65.3986	(247)
Mechanical ventilation fans	37.8419	19.1200	7.2354	(249)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Energy for lighting	340.4401	19.1200	65.0922	(250)
Additional standing charges			94.0000	(251)
Total energy cost			295.6283	(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	1325.1923	0.2160	286.2415	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1748.6254	0.2160	377.7031	(264)
Space and water heating			663.9446	(265)
Pumps and fans	112.8419	0.5190	58.5650	(267)
Energy for lighting	340.4401	0.5190	176.6884	(268)
Total kg/year			899.1980	(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	1325.1923	1.2200	1616.7347	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1748.6254	1.2200	2133.3229	(264)
Space and water heating			3750.0576	(265)
Pumps and fans	112.8419	3.0700	346.4248	(267)
Energy for lighting	340.4401	3.0700	1045.1512	(268)
Primary energy kWh/year			5141.6336	(272)
Primary energy kWh/m2/year			73.2009	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 85
Current environmental impact rating:	B 89

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

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 89

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

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

	Current	Potential	Saving
Electricity	£87	£87	£0
Mains gas	£209	£209	£0
Space heating	£165	£165	£0
Water heating	£65	£65	£0
Lighting	£65	£65	£0
Total cost of fuels	£296	£296	£0
Total cost of uses	£295	£295	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	73 kWh/m²	73 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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


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

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	166.89	(P1)
Transmission heat loss coefficient	37.16	(37)
Summer heat loss coefficient	204.05	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.0400	117.5071	0.4500	0.0000	0.9000	430.2169
total:						430.2169

	Jun	Jul	Aug	
Solar gains	457	430	378	(P4)
Internal gains	394	378	386	
Total summer gains	851	808	764	(P5)
Summer gain/loss ratio	4.17	3.96	3.75	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	20.42	22.11	21.80	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium