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

AES Sustainability Consultants

Property Reference	Emmett - Semi (ASHP)	**Issued on Date**	15/12/2022
Assessment Reference	Emmett - Semi_A (ASHP)	**Prop Type Ref**	
Property	Plot, 3 Bed, K, WC, B, ES		

SAP Rating	86 B	**DER**	16.37	**TER**	27.65
Environmental	88 B	**% DER<TER**	40.80		
CO_2 Emissions (t/year)	1.01	**DFEE**	41.15	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.35		

Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk	**Assessor ID**	Q920-0001
Client			

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 72 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:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.65 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.2 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (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: 4.01 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM 8kW VWL 85/3 A 230v

Secondary heating system: None

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5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.56 kWh/day
Permitted by DBSCG 2.24 OK
Primary pipework insulated: Yes OK

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW 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: 0.1700 0.1800
Maximum 0.7 OK

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9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North East: 3.94 m², No overhang
Windows facing South West: 7.29 m², No overhang
Windows facing North West: 0.66 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Door U-value 0.90 W/m²K
Window U-value 0.90 W/m²K
Thermal bridging y-value 0.034 W/m²K

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.8516	(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		4.0100	
Infiltration rate		0.2005	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1855	(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	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	(38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	(39)
Average = Sum(39)m / 12 =												75.5662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	(40)
HLP (average)												1.0560	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.6309	170.7639	179.5683	161.2881	158.2867	141.7650	136.4640	149.3106	148.9113	167.2310	176.4310	189.0791	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq.(G10)
Total of WWHRS savings												-417.7106	
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													
	147.1624	129.8807	137.8400	126.9340	126.3772	115.4334	114.1646	122.3160	121.1356	132.9098	136.6956	144.1700	(64)
								Total per year (kWh/year) = Sum(64)m =				1555.0193	(64)
Heat gains from water heating, kWh/month													
	87.4659	77.6288	82.7901	75.9673	75.7140	69.4759	68.4579	72.7294	71.8520	78.6879	81.0023	85.9525	(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	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	117.5617	115.5190	111.2770	105.5102	101.7661	96.4943	92.0133	97.7546	99.7945	105.7634	112.5032	115.5275	(72)
Total internal gains													
	394.2740	392.2419	379.6693	359.4626	339.0388	319.3166	306.4865	312.2172	322.5877	342.9964	366.4160	383.8907	(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	
Northeast	3.9400	11.2829	0.4600	0.0000	0.7700	15.7459	(75)
Southwest	4.1400	36.7938	0.4600	0.0000	0.7700	53.9540	(79)
Northwest	0.6600	11.2829	0.4600	0.0000	0.7700	2.6376	(81)
Southwest	3.1500	36.7938	0.4300	0.0000	0.7700	38.3747	(79)

Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270	(83)
Total gains	504.9863	586.9321	662.2722	736.8074	786.5106	774.4674	740.7582	692.5022	637.7375	562.5436	500.1358	477.9178	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9770	0.9605	0.9275	0.8572	0.7357	0.5753	0.4344	0.4798	0.6972	0.8904	0.9619	0.9809	(86)
Tweekday	17.9961	18.3282	18.8157	19.3652	19.7773	19.9752	20.0253	20.0189	19.8989	19.3724	18.5730	17.9034	
Tweekend	20.0082	20.1575	20.3787	20.6351	20.8398	20.9509	20.9862	20.9802	20.9009	20.6322	20.2654	19.9667	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.4693	19.6967	20.0412	20.4303	20.7528	20.9245	20.9787	20.9694	20.8453	20.4324	19.8529	19.4052	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house													
	0.9726	0.9531	0.9139	0.8304	0.6881	0.5032	0.3452	0.3880	0.6295	0.8636	0.9535	0.9772	(89)
Tweekday	17.9961	18.3282	18.8157	19.3652	19.7773	19.9752	20.0253	20.0189	19.8989	19.3724	18.5730	17.9034	
Tweekend	17.9961	18.3282	18.8157	19.3652	19.7773	19.9752	20.0253	20.0189	19.8989	19.3724	18.5730	17.9034	
MIT 2	17.9961	18.3282	18.8157	19.3652	19.7773	19.9752	20.0253	20.0189	19.8989	19.3724	18.5730	17.9034	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.3663	18.6721	19.1236	19.6328	20.0224	20.2138	20.2648	20.2578	20.1367	19.6388	18.8946	18.2808	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3663	18.6721	19.1236	19.6328	20.0224	20.2138	20.2648	20.2578	20.1367	19.6388	18.8946	18.2808	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9622	0.9395	0.8980	0.8175	0.6873	0.5171	0.3669	0.4097	0.6370	0.8504	0.9403	0.9678	(94)
Useful gains	485.8872	551.4113	594.7255	602.3426	540.5806	400.4577	271.7562	283.7418	406.2692	478.4062	470.2679	462.5211	(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	1062.9352	1040.7029	953.9163	811.0383	628.8923	424.2107	276.9370	291.5169	456.1714	683.0242	891.2700	1064.0299	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	429.3237	328.8040	267.2379	150.2609	65.7039	0.0000	0.0000	0.0000	0.0000	152.2358	303.1215	447.5225	(98)

Space heating 2144.2103 (98)
Space heating per m2 (98) / (4) = 29.9638 (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 %)	221.7777	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	966.8284	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	429.3237	328.8040	267.2379	150.2609	65.7039	0.0000	0.0000	0.0000	0.0000	152.2358	303.1215	447.5225	(98)
Space heating efficiency (main heating system 1)	221.7777	221.7777	221.7777	221.7777	221.7777	0.0000	0.0000	0.0000	0.0000	221.7777	221.7777	221.7777	(210)
Space heating fuel (main heating system)	193.5829	148.2583	120.4981	67.7529	29.6260	0.0000	0.0000	0.0000	0.0000	68.6434	136.6781	201.7887	(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	147.1624	129.8807	137.8400	126.9340	126.3772	115.4334	114.1646	122.3160	121.1356	132.9098	136.6956	144.1700	(64)
Efficiency of water heater												170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	86.4238	76.2748	80.9490	74.5443	74.2173	67.7903	67.0452	71.8323	71.1390	78.0537	80.2769	84.6664	(219)

Water heating fuel used	913.2131	(219)
Annual totals kWh/year		
Space heating fuel - main system	966.8284	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)

mechanical ventilation fans (SFP = 0.2294)	49.2222	(230a)
Total electricity for the above, kWh/year	49.2222	(231)
Electricity for lighting (calculated in Appendix L)	327.6189	(232)
Total delivered energy for all uses	2256.8826	(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	966.8284	0.5190	501.7840	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	913.2131	0.5190	473.9576	(264)
Space and water heating			975.7416	(265)
Pumps and fans	49.2222	0.5190	25.5463	(267)
Energy for lighting	327.6189	0.5190	170.0342	(268)
Total CO2, kg/year			1171.3221	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3700	(273)

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

DER		16.3700	ZC1
Total Floor Area	TFA	71.5600	
Assumed number of occupants	N	2.2834	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6371	ZC2
CO2 emissions from cooking, equation (L16)		2.4288	ZC3
Total CO2 emissions		35.4359	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		35.4359	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.8516	(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) =	0.1706	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4206	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3891	(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	0.4960	0.4863	0.4766	0.4280	0.4182	0.3696	0.3696	0.3599	0.3891	0.4182	0.4377	0.4571	(22b)
Effective ac	0.6230	0.6183	0.6136	0.5916	0.5875	0.5683	0.5683	0.5648	0.5757	0.5875	0.5958	0.6045	(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			1.9800	1.0000	1.9800			(26)
TER Opening Type (Uw = 1.40)			11.8900	1.3258	15.7633			(27)
FP McCann System			36.4000	0.1300	4.7320			(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.1800	12.7116			(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.1300	4.5695			(30)
Porch Roof - 200mm	1.2500		1.2500	0.1300	0.1625			(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.9189			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7628	(36)
Total fabric heat loss						(33) + (36) =	49.6817	(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	36.1550	35.8778	35.6061	34.3297	34.0909	32.9792	32.9792	32.7733	33.4074	34.0909	34.5740	35.0790	(38)
Heat transfer coeff	85.8367	85.5595	85.2877	84.0113	83.7725	82.6608	82.6608	82.4550	83.0890	83.7725	84.2556	84.7607	(39)
Average = Sum(39)m / 12 =												84.0102	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1995	1.1956	1.1918	1.1740	1.1707	1.1551	1.1551	1.1522	1.1611	1.1707	1.1774	1.1845	(40)
HLP (average)												1.1740	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)

Water storage loss:		
Store volume	200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.6525	(48)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	195.1801	172.1633	181.1176	162.7874	159.8360	143.2643	138.0132	150.8599	150.4106	168.7802	177.9303	190.6284	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	195.1801	172.1633	181.1176	162.7874	159.8360	143.2643	138.0132	150.8599	150.4106	168.7802	177.9303	190.6284	(64)
								Total per year (kWh/year) = Sum(64)m =				1990.9713	(64)
Heat gains from water heating, kWh/month													
	88.7053	78.7482	84.0295	77.1668	76.9534	70.6753	69.6973	73.9688	73.0515	79.9274	82.2018	87.1919	(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	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	119.2276	117.1849	112.9429	107.1760	103.4320	98.1601	93.6792	99.4205	101.4604	107.4293	114.1691	117.1934	(72)
Total internal gains													
	398.9399	396.9078	384.3352	364.1285	343.7047	323.9824	311.1524	316.8830	327.2536	347.6623	371.0819	388.5566	(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	
Northeast	3.9400	11.2829	0.6300	0.7000	0.7700	13.5860	(75)
Southwest	7.2900	36.7938	0.6300	0.7000	0.7700	81.9737	(79)
Northwest	0.6600	11.2829	0.6300	0.7000	0.7700	2.2758	(81)

Solar gains	97.8355	171.9186	249.2210	332.2538	393.5622	400.1339	381.8525	334.6739	277.7490	193.7800	118.1438	83.1059	(83)
Total gains	496.7754	568.8264	633.5562	696.3823	737.2669	724.1163	693.0050	651.5569	605.0026	541.4422	489.2257	471.6625	(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	57.8942	58.0818	58.2668	59.1521	59.3207	60.1185	60.1185	60.2686	59.8087	59.3207	58.9806	58.6291	
alpha	4.8596	4.8721	4.8845	4.9435	4.9547	5.0079	5.0079	5.0179	4.9872	4.9547	4.9320	4.9086	
util living area													
	0.9962	0.9921	0.9810	0.9457	0.8542	0.6824	0.5147	0.5654	0.8098	0.9619	0.9921	0.9970	(86)
MIT	19.7792	19.9416	20.1988	20.5323	20.8047	20.9543	20.9908	20.9857	20.8908	20.5418	20.1044	19.7562	(87)
Th 2	19.9204	19.9235	19.9265	19.9409	19.9435	19.9561	19.9561	19.9584	19.9512	19.9435	19.9381	19.9324	(88)
util rest of house													
	0.9949	0.9894	0.9744	0.9261	0.8037	0.5901	0.3978	0.4458	0.7309	0.9441	0.9890	0.9961	(89)
MIT 2	18.3077	18.5460	18.9197	19.4000	19.7558	19.9264	19.9528	19.9527	19.8669	19.4235	18.7946	18.2826	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.6774	18.8966	19.2411	19.6845	20.0194	20.1847	20.2136	20.2122	20.1242	19.7045	19.1237	18.6528	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6774	18.8966	19.2411	19.6845	20.0194	20.1847	20.2136	20.2122	20.1242	19.7045	19.1237	18.6528	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9859	0.9688	0.9203	0.8078	0.6115	0.4274	0.4759	0.7455	0.9389	0.9855	0.9943	(94)
Useful gains	493.1937	560.7827	613.7880	640.8983	595.5833	442.8154	296.1761	310.0881	451.0500	508.3833	482.1505	468.9751	(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													
	1234.1104	1197.5423	1086.6591	906.0183	696.9354	461.6326	298.7039	314.3377	500.5424	762.7087	1013.0653	1225.0330	(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													
	551.2420	427.9024	351.8161	190.8864	75.4060	0.0000	0.0000	0.0000	0.0000	189.2181	382.2587	562.5071	(98)
Space heating												2731.2368	(98)
Space heating per m2											(98) / (4) =	38.1671	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2921.1089	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	551.2420	427.9024	351.8161	190.8864	75.4060	0.0000	0.0000	0.0000	0.0000	189.2181	382.2587	562.5071	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	589.5637	457.6496	376.2739	204.1565	80.6481	0.0000	0.0000	0.0000	0.0000	202.3723	408.8328	601.6119	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	195.1801	172.1633	181.1176	162.7874	159.8360	143.2643	138.0132	150.8599	150.4106	168.7802	177.9303	190.6284	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.4344	87.1474	86.5558	85.2394	82.9435	79.8000	79.8000	79.8000	79.8000	85.1192	86.8032	87.5294	(217)
Fuel for water heating, kWh/month	223.2303	197.5540	209.2496	190.9768	192.7047	179.5291	172.9489	189.0475	188.4845	198.2870	204.9814	217.7880	(219)
Water heating fuel used												2364.7819	(219)
Annual totals kWh/year													
Space heating fuel - main system												2921.1089	(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)	327.6189	(232)
Total delivered energy for all uses	5688.5097	(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	2921.1089	0.2160	630.9595	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.7819	0.2160	510.7929	(264)
Space and water heating			1141.7524	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	327.6189	0.5190	170.0342	(268)
Total CO2, kg/m2/year			1350.7116	(272)
Emissions per m2 for space and water heating			15.9552	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.3761	(272b)
Emissions per m2 for pumps and fans			0.5439	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9552 * 1.55) + 2.3761 + 0.5439, rounded to 2 d.p.			27.6500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.8516	(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) =	0.1706	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3711	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3433	(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	0.4377	0.4291	0.4205	0.3776	0.3690	0.3261	0.3261	0.3175	0.3433	0.3690	0.3862	0.4033	(22b)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5813	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	34.5734	34.3576	34.1461	33.1524	32.9665	32.1011	32.1011	31.9408	32.4345	32.9665	33.3426	33.7358	(38)
Heat transfer coeff	81.1241	80.9083	80.6968	79.7031	79.5172	78.6518	78.6518	78.4915	78.9852	79.5172	79.8933	80.2865	(39)
Average = Sum(39)m / 12 =												79.7022	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1337	1.1306	1.1277	1.1138	1.1112	1.0991	1.0991	1.0969	1.1038	1.1112	1.1165	1.1219	(40)
HLP (average)												1.1138	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(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)
Heat gains from water heating, kWh/month													
	30.6540	26.8102	27.6657	24.1196	23.1434	19.9710	18.5060	21.2359	21.4896	25.0440	27.3375	29.6867	(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	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	41.2016	39.8961	37.1851	33.4995	31.1067	27.7374	24.8737	28.5429	29.8466	33.6613	37.9687	39.9015	(72)
Total internal gains													
	317.9139	316.6190	305.5773	287.4520	268.3794	250.5597	239.3469	243.0055	252.6398	270.8943	291.8815	308.2648	(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	
Northeast	3.9400	11.2829	0.4600	0.0000	0.7700	15.7459	(75)
Southwest	4.1400	36.7938	0.4600	0.0000	0.7700	53.9540	(79)
Northwest	0.6600	11.2829	0.4600	0.0000	0.7700	2.6376	(81)
Southwest	3.1500	36.7938	0.4300	0.0000	0.7700	38.3747	(79)

Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270	(83)
Total gains	428.6261	511.3092	588.1802	664.7967	715.8511	705.7105	673.6185	623.2905	567.7896	490.4416	425.6013	402.2918	(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	36.0408	36.1369	36.2317	36.6834	36.7691	37.1737	37.1737	37.2496	37.0168	36.7691	36.5960	36.4168	
alpha	3.4027	3.4091	3.4154	3.4456	3.4513	3.4782	3.4782	3.4833	3.4678	3.4513	3.4397	3.4278	
util living area													
	0.9863	0.9745	0.9501	0.8934	0.7878	0.6323	0.4878	0.5394	0.7600	0.9257	0.9769	0.9889	(86)
MIT	19.1787	19.4269	19.8036	20.2721	20.6548	20.8873	20.9655	20.9510	20.7765	20.2667	19.6360	19.1357	(87)
Th 2	19.9734	19.9759	19.9783	19.9896	19.9917	20.0016	20.0016	20.0034	19.9978	19.9917	19.9874	19.9830	(88)
util rest of house													
	0.9835	0.9694	0.9398	0.8706	0.7425	0.5563	0.3874	0.4375	0.6941	0.9050	0.9713	0.9865	(89)
MIT 2	18.3125	18.5597	18.9313	19.3902	19.7403	19.9379	19.9885	19.9834	19.8564	19.3960	18.7776	18.2769	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.5301	18.7776	19.1505	19.6118	19.9701	20.1765	20.2340	20.2265	20.0876	19.6148	18.9933	18.4927	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5301	18.7776	19.1505	19.6118	19.9701	20.1765	20.2340	20.2265	20.0876	19.6148	18.9933	18.4927	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9615	0.9293	0.8607	0.7414	0.5704	0.4117	0.4615	0.7007	0.8955	0.9641	0.9820	(94)
Useful gains	419.2511	491.6353	546.6174	572.2071	530.7194	402.5721	277.2965	287.6300	397.8287	439.1789	410.3376	395.0324	(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													
	1154.4075	1122.8117	1020.8516	853.7620	657.6156	438.5980	285.8218	300.3472	472.9308	716.8294	950.1929	1147.5068	(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													
	546.9564	424.1505	352.8302	202.7196	94.4108	0.0000	0.0000	0.0000	0.0000	206.5720	388.6958	559.8410	(98)
Space heating												2776.1763	(98)
Space heating per m2											(98) / (4) =	38.7951	(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

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	739.3270	582.0234	596.5358	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8496	0.9022	0.8794	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	628.1202	525.1207	524.6204	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	909.9549	870.7450	813.3868	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	202.9210	257.1445	214.8422	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												674.9077	(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													
	0.0000	0.0000	0.0000	0.0000	0.0000	50.7302	64.2861	53.7106	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												168.7269	(107)
Space cooling per m2												2.3578	(108)
Energy for space heating												38.7951	(99)
Energy for space cooling												2.3578	(108)
Total												41.1529	(109)
Dwelling Fabric Energy Efficiency (DFEE)												41.2	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.8516	(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) =	0.1706	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4206	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3891	(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	0.4960	0.4863	0.4766	0.4280	0.4182	0.3696	0.3696	0.3599	0.3891	0.4182	0.4377	0.4571	(22b)
Effective ac	0.6230	0.6183	0.6136	0.5916	0.5875	0.5683	0.5683	0.5648	0.5757	0.5875	0.5958	0.6045	(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			1.9800	1.0000	1.9800			(26)
TER Opening Type (Uw = 1.40)			11.8900	1.3258	15.7633			(27)
FP McCann System			36.4000	0.1300	4.7320			(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.1800	12.7116			(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.1300	4.5695			(30)
Porch Roof - 200mm	1.2500		1.2500	0.1300	0.1625			(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.9189			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7628	(36)
Total fabric heat loss (33) + (36) =	49.6817	(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	36.1550	35.8778	35.6061	34.3297	34.0909	32.9792	32.9792	32.7733	33.4074	34.0909	34.5740	35.0790	(38)
Heat transfer coeff	85.8367	85.5595	85.2877	84.0113	83.7725	82.6608	82.6608	82.4550	83.0890	83.7725	84.2556	84.7607	(39)
Average = Sum(39)m / 12 =												84.0102	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1995	1.1956	1.1918	1.1740	1.1707	1.1551	1.1551	1.1522	1.1611	1.1707	1.1774	1.1845	(40)
HLP (average)												1.1740	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(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 TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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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
               30.6540   26.8102   27.6657   24.1196   23.1434   19.9710   18.5060   21.2359   21.4896   25.0440   27.3375   29.6867 (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          114.1697  114.1697  114.1697  114.1697  114.1697  114.1697  114.1697  114.1697  114.1697  114.1697  114.1697  114.1697 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               18.5511   16.4770   13.4000   10.1446    7.5832    6.4021    6.9177    8.9919   12.0689   15.3242   17.8856   19.0667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              200.9103  202.9951  197.7414  186.5569  172.4386  159.1693  150.3046  148.2198  153.4735  164.6579  178.7763  192.0456 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               34.4170   34.4170   34.4170   34.4170   34.4170   34.4170   34.4170   34.4170   34.4170   34.4170   34.4170   34.4170 (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)
              -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358  -91.3358 (71)
Water heating gains (Table 5)
               41.2016   39.8961   37.1851   33.4995   31.1067   27.7374   24.8737   28.5429   29.8466   33.6613   37.9687   39.9015 (72)
Total internal gains
              317.9139  316.6190  305.5773  287.4520  268.3794  250.5597  239.3469  243.0055  252.6398  270.8943  291.8815  308.2648 (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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Northeast                                 3.9400          11.2829          0.6300            0.7000          0.7700          13.5860 (75)
Southwest                                 7.2900          36.7938          0.6300            0.7000          0.7700          81.9737 (79)
Northwest                                 0.6600          11.2829          0.6300            0.7000          0.7700           2.2758 (81)
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Solar gains    97.8355  171.9186  249.2210  332.2538  393.5622  400.1339  381.8525  334.6739  277.7490  193.7800  118.1438   83.1059 (83)
Total gains   415.7494  488.5376  554.7984  619.7057  661.9416  650.6936  621.1994  577.6794  530.3889  464.6743  410.0253  391.3707 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            57.8942   58.0818   58.2668   59.1521   59.3207   60.1185   60.1185   60.2686   59.8087   59.3207   58.9806   58.6291
alpha           4.8596    4.8721    4.8845    4.9435    4.9547    5.0079    5.0079    5.0179    4.9872    4.9547    4.9320    4.9086
util living area
                0.9983    0.9959    0.9889    0.9643    0.8920    0.7373    0.5682    0.6269    0.8636    0.9788    0.9963    0.9987 (86)

MIT            19.6753   19.8403   20.1039   20.4526   20.7534   20.9354   20.9859   20.9775   20.8491   20.4555   20.0041   19.6526 (87)
Th 2           19.9204   19.9235   19.9265   19.9409   19.9435   19.9561   19.9561   19.9584   19.9512   19.9435   19.9381   19.9324 (88)
util rest of house
                0.9977    0.9944    0.9848    0.9503    0.8492    0.6453    0.4422    0.4994    0.7948    0.9679    0.9948    0.9983 (89)
MIT 2          18.7159   18.8828   19.1467   19.4983   19.7756   19.9261   19.9525   19.9520   19.8666   19.5082   19.0582   18.7028 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2513 (91)
MIT            18.9570   19.1233   19.3872   19.7381   20.0212   20.1797   20.2121   20.2096   20.1134   19.7462   19.2959   18.9415 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT   18.9570   19.1233   19.3872   19.7381   20.0212   20.1797   20.2121   20.2096   20.1134   19.7462   19.2959   18.9415 (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     0.9969    0.9930    0.9821    0.9469    0.8528    0.6667    0.4742    0.5318    0.8072    0.9652    0.9935    0.9977 (94)
Useful gains  414.4660  485.0951  544.8775  586.8238  564.5270  433.7889  294.5779  307.2073  428.1117  448.5052  407.3606  390.4687 (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
            1258.1075 1216.9415 1099.1184  910.5219  697.0918  461.2235  298.5822  314.1234  499.6498  766.2006 1027.5707 1249.4968 (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
              627.6693  491.8008  412.3552  233.0626   98.6282    0.0000    0.0000    0.0000    0.0000  236.3653  446.5512  639.1169 (98)
Space heating                                                                                                          3185.5496 (98)
Space heating per m2                                                                                   (98) / (4) =      44.5158 (99)


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8c. Space cooling requirement
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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  777.0118  611.6901  626.6577    0.0000    0.0000    0.0000    0.0000 (100)
Utilisation     0.0000    0.0000    0.0000    0.0000    0.0000    0.8667    0.9262    0.9030    0.0000    0.0000    0.0000    0.0000 (101)
Useful loss     0.0000    0.0000    0.0000    0.0000    0.0000  673.4708  566.5608  565.8726    0.0000    0.0000    0.0000    0.0000 (102)
Total gains     0.0000    0.0000    0.0000    0.0000    0.0000  845.6493  809.4759  760.0750    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  123.9686  180.7288  144.4866    0.0000    0.0000    0.0000    0.0000 (104)
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
Cooled fraction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
Intermittency factor (Table 10b)
```

												fC = cooled area / (4) =	1.0000 (105)
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)		
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	30.9921	45.1822	36.1217	0.0000	0.0000	0.0000	0.0000 (107)		

```
Space cooling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
Space cooling per m2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
Energy for space heating                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
Energy for space cooling                                                                                                                                                                                                                                                                                                                                                                                                
Total                                                                                                
Target Fabric Energy Efficiency (TFEE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
```

Space cooling	449.1840 (104)
Space cooling per m2	112.2960 (107)
Energy for space heating	1.5693 (108)
Energy for space cooling	44.5158 (99)
Total	1.5693 (108)
Target Fabric Energy Efficiency (TFEE)	46.0850 (109)
	53.0 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.8516	(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			4.0100	
Infiltration rate			0.2005	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.1855	(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	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	(38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	(39)
Average = Sum(39)m / 12 =												75.5662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	(40)
HLP (average)												1.0560	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.6309	170.7639	179.5683	161.2881	158.2867	141.7650	136.4640	149.3106	148.9113	167.2310	176.4310	189.0791	(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													
	193.6309	170.7639	179.5683	161.2881	158.2867	141.7650	136.4640	149.3106	148.9113	167.2310	176.4310	189.0791	(64)
								Total per year (kWh/year) = Sum(64)m =				1972.7299	(64)
RHI water heating demand												1973	(64)
Heat gains from water heating, kWh/month													
	87.4659	77.6288	82.7901	75.9673	75.7140	69.4759	68.4579	72.7294	71.8520	78.6879	81.0023	85.9525	(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	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	117.5617	115.5190	111.2770	105.5102	101.7661	96.4943	92.0133	97.7546	99.7945	105.7634	112.5032	115.5275	(72)
Total internal gains													
	560.4573	556.3407	536.5650	505.9666	474.7468	446.7172	430.2944	438.1095	455.6831	486.4836	520.6991	546.4812	(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	
Northeast	3.9400	12.9236	0.4600	0.0000	0.7700	18.0354	(75)
Southwest	4.1400	40.4699	0.4600	0.0000	0.7700	59.3446	(79)
Northwest	0.6600	12.9236	0.4600	0.0000	0.7700	3.0212	(81)
Southwest	3.1500	40.4699	0.4300	0.0000	0.7700	42.2087	(79)

Solar gains	122.6099	194.3856	279.9164	387.3747	449.2976	489.7632	461.9781	412.4864	339.1231	234.3692	151.7827	103.0884	(83)
Total gains	683.0672	750.7263	816.4814	893.3413	924.0445	936.4804	892.2725	850.5959	794.8062	720.8527	672.4818	649.5696	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9382	0.9146	0.8615	0.7564	0.5964	0.3940	0.2609	0.2820	0.5200	0.7758	0.9014	0.9459	(86)
Tweekday	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	
Tweekend	20.2765	20.3843	20.5815	20.7895	20.9311	20.9885	20.9981	20.9975	20.9678	20.8051	20.5145	20.2424	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8834	20.0476	20.3541	20.6714	20.8936	20.9824	20.9971	20.9962	20.9497	20.6992	20.2419	19.8308	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house													
	0.9273	0.9001	0.8383	0.7180	0.5387	0.3218	0.1807	0.1982	0.4440	0.7313	0.8820	0.9362	(89)
Tweekday	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	
Tweekend	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	
MIT 2	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.9140	19.1307	19.5246	19.9237	20.1779	20.2663	20.2776	20.2770	20.2387	19.9617	19.3956	18.8454	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9140	19.1307	19.5246	19.9237	20.1779	20.2663	20.2776	20.2770	20.2387	19.9617	19.3956	18.8454	(93)

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8. Space heating requirement

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9116	0.8838	0.8243	0.7132	0.5475	0.3393	0.2008	0.2193	0.4605	0.7275	0.8666	0.9210	(94)
Useful gains	622.6679	663.5012	673.0077	637.0872	505.9530	317.7044	179.1999	186.5329	366.0112	524.4298	582.7750	598.2452	(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	1043.8745	1022.4652	916.2105	757.4501	542.4061	322.3894	179.6630	187.1806	380.7542	631.8647	861.1246	1038.6916	(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	313.3777	241.2238	180.9429	86.6613	27.1211	0.0000	0.0000	0.0000	0.0000	79.9316	200.4117	327.6921	(98)
Space heating												1457.3621	(98)
RHI space heating demand												1457	(98)

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.8516	(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		4.0100	
Infiltration rate		0.2005	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1855	(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	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	(38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	(39)
Average = Sum(39)m / 12 =												75.5662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	(40)
HLP (average)												1.0560	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.6309	170.7639	179.5683	161.2881	158.2867	141.7650	136.4640	149.3106	148.9113	167.2310	176.4310	189.0791	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq.(G10)
Total of WWHRS savings												-417.7106	
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													
	147.1624	129.8807	137.8400	126.9340	126.3772	115.4334	114.1646	122.3160	121.1356	132.9098	136.6956	144.1700	(64)
								Total per year (kWh/year) = Sum(64)m =				1555.0193	(64)
Heat gains from water heating, kWh/month													
	87.4659	77.6288	82.7901	75.9673	75.7140	69.4759	68.4579	72.7294	71.8520	78.6879	81.0023	85.9525	(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	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	117.5617	115.5190	111.2770	105.5102	101.7661	96.4943	92.0133	97.7546	99.7945	105.7634	112.5032	115.5275	(72)
Total internal gains													
	560.4573	556.3407	536.5650	505.9666	474.7468	446.7172	430.2944	438.1095	455.6831	486.4836	520.6991	546.4812	(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	
Northeast	3.9400	11.2829	0.4600	0.0000	0.7700	15.7459	(75)
Southwest	4.1400	36.7938	0.4600	0.0000	0.7700	53.9540	(79)
Northwest	0.6600	11.2829	0.4600	0.0000	0.7700	2.6376	(81)
Southwest	3.1500	36.7938	0.4300	0.0000	0.7700	38.3747	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270	(83)
Total gains	671.1695	751.0309	819.1679	883.3113	922.2186	901.8680	864.5661	818.3945	770.8329	706.0308	654.4189	640.5082	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9483	0.9235	0.8789	0.7949	0.6657	0.5079	0.3767	0.4131	0.6116	0.8215	0.9217	0.9552	(86)
Tweekday	18.4034	18.6927	19.1038	19.5452	19.8562	19.9966	20.0297	20.0261	19.9507	19.5735	18.9132	18.3121	
Tweekend	20.1928	20.3251	20.5152	20.7262	20.8854	20.9670	20.9913	20.9877	20.9355	20.7343	20.4229	20.1513	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7542	19.9560	20.2517	20.5724	20.8231	20.9493	20.9865	20.9810	20.8993	20.5899	20.0989	19.6901	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house													
	0.9394	0.9108	0.8591	0.7623	0.6161	0.4403	0.2976	0.3313	0.5438	0.7855	0.9065	0.9474	(89)
Tweekday	18.4034	18.6927	19.1038	19.5452	19.8562	19.9966	20.0297	20.0261	19.9507	19.5735	18.9132	18.3121	
Tweekend	18.4034	18.6927	19.1038	19.5452	19.8562	19.9966	20.0297	20.0261	19.9507	19.5735	18.9132	18.3121	
MIT 2	18.4034	18.6927	19.1038	19.5452	19.8562	19.9966	20.0297	20.0261	19.9507	19.5735	18.9132	18.3121	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.7428	19.0101	19.3922	19.8033	20.0991	20.2360	20.2701	20.2661	20.1891	19.8289	19.2111	18.6584	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7428	19.0101	19.3922	19.8033	20.0991	20.2360	20.2701	20.2661	20.1891	19.8289	19.2111	18.6584	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9243	0.8945	0.8438	0.7537	0.6195	0.4547	0.3170	0.3512	0.5550	0.7768	0.8907	0.9330	(94)
Useful gains	620.3382	671.7762	691.2217	665.7143	571.2880	410.0564	274.1028	287.3966	427.8332	548.4412	582.8846	597.6045	(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	1091.3891	1066.2458	974.2146	823.9202	634.6906	425.8913	277.3381	292.1434	460.1271	697.3902	915.1933	1092.5651	(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	350.4618	265.0836	210.5468	113.9082	47.1715	0.0000	0.0000	0.0000	0.0000	110.8181	239.2622	368.2507	(98)
Space heating												1705.5029	(98)
Space heating per m2											(98) / (4) =	23.8332	(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 %)	221.7777	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	769.0145	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	350.4618	265.0836	210.5468	113.9082	47.1715	0.0000	0.0000	0.0000	0.0000	110.8181	239.2622	368.2507	(98)
Space heating efficiency (main heating system 1)	221.7777	221.7777	221.7777	221.7777	221.7777	0.0000	0.0000	0.0000	0.0000	221.7777	221.7777	221.7777	(210)
Space heating fuel (main heating system)	158.0239	119.5267	94.9359	51.3614	21.2697	0.0000	0.0000	0.0000	0.0000	49.9681	107.8838	166.0449	(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	147.1624	129.8807	137.8400	126.9340	126.3772	115.4334	114.1646	122.3160	121.1356	132.9098	136.6956	144.1700	(64)
Efficiency of water heater												170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	86.4238	76.2748	80.9490	74.5443	74.2173	67.7903	67.0452	71.8323	71.1390	78.0537	80.2769	84.6664	(219)
Water heating fuel used												913.2131	(219)

Annual totals kWh/year

Space heating fuel - main system	769.0145	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)

mechanical ventilation fans (SFP = 0.2294)	49.2222	(230a)
Total electricity for the above, kWh/year	49.2222	(231)
Electricity for lighting (calculated in Appendix L)	327.6189	(232)
Total delivered energy for all uses	2059.0687	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	769.0145	13.1900	101.4330	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	913.2131	13.1900	120.4528	(247)
Mechanical ventilation fans	49.2222	13.1900	6.4924	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	327.6189	13.1900	43.2129	(250)
Additional standing charges			0.0000	(251)
Total energy cost			271.5912	(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] =	0.9786	(257)
SAP value		86.3482	
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	769.0145	0.5190	399.1185	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	913.2131	0.5190	473.9576	(264)
Space and water heating			873.0761	(265)
Pumps and fans	49.2222	0.5190	25.5463	(267)
Energy for lighting	327.6189	0.5190	170.0342	(268)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total kg/year	1068.6566 (272)
CO2 emissions per m2	14.9300 (273)
EI value	87.7145
EI rating	88 (274)
EI band	B

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 2.2178 = 5.947, stars = 3
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 2.2178 = 0.2340, stars = 4
Water heating energy efficiency	13.19 / 1.7028 = 7.746, stars = 3
Water heating environmental impact	0.519 / 1.7028 = 0.3048, stars = 5

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	175.8516	(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		4.0100	
Infiltration rate		0.2005	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1855	(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	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	(38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	(39)
Average = Sum(39)m / 12 =												75.5662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	(40)
HLP (average)												1.0560	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.6309	170.7639	179.5683	161.2881	158.2867	141.7650	136.4640	149.3106	148.9113	167.2310	176.4310	189.0791	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq.(G10)
Total of WWHRS savings												-417.7106	
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													
	147.1624	129.8807	137.8400	126.9340	126.3772	115.4334	114.1646	122.3160	121.1356	132.9098	136.6956	144.1700	(64)
								Total per year (kWh/year) = Sum(64)m =				1555.0193	(64)
Heat gains from water heating, kWh/month													
	87.4659	77.6288	82.7901	75.9673	75.7140	69.4759	68.4579	72.7294	71.8520	78.6879	81.0023	85.9525	(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	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	117.5617	115.5190	111.2770	105.5102	101.7661	96.4943	92.0133	97.7546	99.7945	105.7634	112.5032	115.5275	(72)
Total internal gains													
	560.4573	556.3407	536.5650	505.9666	474.7468	446.7172	430.2944	438.1095	455.6831	486.4836	520.6991	546.4812	(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	
Northeast	3.9400	12.9236	0.4600	0.0000	0.7700	18.0354	(75)
Southwest	4.1400	40.4699	0.4600	0.0000	0.7700	59.3446	(79)
Northwest	0.6600	12.9236	0.4600	0.0000	0.7700	3.0212	(81)
Southwest	3.1500	40.4699	0.4300	0.0000	0.7700	42.2087	(79)

Solar gains	122.6099	194.3856	279.9164	387.3747	449.2976	489.7632	461.9781	412.4864	339.1231	234.3692	151.7827	103.0884	(83)
Total gains	683.0672	750.7263	816.4814	893.3413	924.0445	936.4804	892.2725	850.5959	794.8062	720.8527	672.4818	649.5696	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9382	0.9146	0.8615	0.7564	0.5964	0.3940	0.2609	0.2820	0.5200	0.7758	0.9014	0.9459	(86)
Tweekday	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	
Tweekend	20.2765	20.3843	20.5815	20.7895	20.9311	20.9885	20.9981	20.9975	20.9678	20.8051	20.5145	20.2424	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8834	20.0476	20.3541	20.6714	20.8936	20.9824	20.9971	20.9962	20.9497	20.6992	20.2419	19.8308	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house													
	0.9273	0.9001	0.8383	0.7180	0.5387	0.3218	0.1807	0.1982	0.4440	0.7313	0.8820	0.9362	(89)
Tweekday	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	
Tweekend	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	
MIT 2	18.5888	18.8230	19.2462	19.6728	19.9377	20.0260	20.0361	20.0357	20.0001	19.7143	19.1116	18.5148	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.9140	19.1307	19.5246	19.9237	20.1779	20.2663	20.2776	20.2770	20.2387	19.9617	19.3956	18.8454	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9140	19.1307	19.5246	19.9237	20.1779	20.2663	20.2776	20.2770	20.2387	19.9617	19.3956	18.8454	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9116	0.8838	0.8243	0.7132	0.5475	0.3393	0.2008	0.2193	0.4605	0.7275	0.8666	0.9210	(94)
Useful gains	622.6679	663.5012	673.0077	637.0872	505.9530	317.7044	179.1999	186.5329	366.0112	524.4298	582.7750	598.2452	(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	1043.8745	1022.4652	916.2105	757.4501	542.4061	322.3894	179.6630	187.1806	380.7542	631.8647	861.1246	1038.6916	(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	313.3777	241.2238	180.9429	86.6613	27.1211	0.0000	0.0000	0.0000	0.0000	79.9316	200.4117	327.6921	(98)
Space heating												1457.3621	(98)
Space heating per m2											(98) / (4) =	20.3656	(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 %)	221.7777	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	657.1273	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	313.3777	241.2238	180.9429	86.6613	27.1211	0.0000	0.0000	0.0000	0.0000	79.9316	200.4117	327.6921	(98)
Space heating efficiency (main heating system 1)	221.7777	221.7777	221.7777	221.7777	221.7777	0.0000	0.0000	0.0000	0.0000	221.7777	221.7777	221.7777	(210)
Space heating fuel (main heating system)	141.3026	108.7683	81.5875	39.0757	12.2289	0.0000	0.0000	0.0000	0.0000	36.0413	90.3660	147.7570	(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	147.1624	129.8807	137.8400	126.9340	126.3772	115.4334	114.1646	122.3160	121.1356	132.9098	136.6956	144.1700	(64)
Efficiency of water heater												170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	86.4238	76.2748	80.9490	74.5443	74.2173	67.7903	67.0452	71.8323	71.1390	78.0537	80.2769	84.6664	(219)
Water heating fuel used												913.2131	(219)

Annual totals kWh/year

Space heating fuel - main system	657.1273	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)

mechanical ventilation fans (SFP = 0.2294)	49.2222	(230a)
Total electricity for the above, kWh/year	49.2222	(231)
Electricity for lighting (calculated in Appendix L)	327.6189	(232)
Total delivered energy for all uses	1947.1815	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	657.1273	16.9600	111.4488	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	913.2131	16.9600	154.8809	(247)
Mechanical ventilation fans	49.2222	16.9600	8.3481	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	327.6189	16.9600	55.5642	(250)
Additional standing charges			0.0000	(251)
Total energy cost			330.2420	(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	657.1273	0.5190	341.0491	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	913.2131	0.5190	473.9576	(264)
Space and water heating			815.0067	(265)
Pumps and fans	49.2222	0.5190	25.5463	(267)
Energy for lighting	327.6189	0.5190	170.0342	(268)
Total kg/year			1010.5872	(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	657.1273	3.0700	2017.3809	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)

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

Water heating (other fuel)	913.2131	3.0700	2803.5642 (264)
Space and water heating			4820.9451 (265)
Pumps and fans	49.2222	3.0700	151.1121 (267)
Energy for lighting	327.6189	3.0700	1005.7900 (268)
Primary energy kWh/year			5977.8472 (272)
Primary energy kWh/m2/year			83.5362 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(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	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Recommended
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
N Solar water heating	+ 2.4	-£ 62	-191 kg (18.9%)
U Solar photovoltaic panels	+ 11.5	-£ 309	-947 kg (115.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	2.67 kg/m²	B 89	B 90
Solar photovoltaic panels	£309	13.23 kg/m²	A 100	A 100
Total Savings	£372	15.90 kg/m²		

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£330	£268	£62
Space heating	£120	£120	-£0
Water heating	£155	£92	£63
Lighting	£56	£56	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£330	-£41	£371
Total cost of uses	£331	-£41	£372
Delivered energy	27 kWh/m²	-3 kWh/m²	31 kWh/m²
Carbon dioxide emissions	1.0 tonnes	-0.1 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	-2 kg/m²	16 kg/m²
Primary energy	84 kWh/m²	-11 kWh/m²	94 kWh/m²

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.8516	(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		4.0100	
Infiltration rate		0.2005	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1855	(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	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	(38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	(39)
Average = Sum(39)m / 12 =												75.5662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	(40)
HLP (average)												1.0560	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.6309	170.7639	178.1726	154.5345	145.4924	129.1582	123.4370	137.2142	143.5085	165.8352	176.4310	189.0791	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq.(G10)
Total of WWHRS savings												-417.7106	
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.8627	(H8)
Utilisation factor												0.4154	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												88.4306	(H14)
Volume ratio Veff/V												0.8481	(H15)
Solar storage volume factor												0.9671	(H16)
Solar input												-640.6368	(H17)
Solar input	-18.5772	-31.0000	-52.7965	-70.7578	-87.4152	-85.9431	-84.8073	-74.0966	-58.0325	-39.6294	-22.0352	-15.5459	(63)
								Solar input (sum of months) = Sum(63)m =				-640.6368	(63)
Output from w/h													
	128.5852	98.8808	83.6477	49.4227	26.1676	16.8836	16.3303	36.1229	57.7002	91.8847	114.6604	128.6241	(64)
								Total per year (kWh/year) = Sum(64)m =				848.9101	(64)
Heat gains from water heating, kWh/month													
	87.4659	77.6288	81.6735	70.5644	65.4785	59.3905	58.0364	63.0523	67.5297	77.5714	81.0023	85.9525	(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	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	117.5617	115.5190	109.7762	98.0062	88.0088	82.4868	78.0059	84.7477	93.7913	104.2626	112.5032	115.5275	(72)
Total internal gains													
	560.4573	556.3407	535.0642	498.4626	460.9895	432.7098	416.2869	425.1025	449.6799	484.9828	520.6991	546.4812	(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	
Northeast	3.9400	11.2829	0.4600	0.0000	0.7700	15.7459	(75)
Southwest	4.1400	36.7938	0.4600	0.0000	0.7700	53.9540	(79)
Northwest	0.6600	11.2829	0.4600	0.0000	0.7700	2.6376	(81)
Southwest	3.1500	36.7938	0.4300	0.0000	0.7700	38.3747	(79)

Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270	(83)
Total gains	671.1695	751.0309	817.6671	875.8073	908.4613	887.8606	850.5586	805.3876	764.8297	704.5300	654.4189	640.5082	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9483	0.9235	0.8794	0.7981	0.6725	0.5147	0.3825	0.4192	0.6152	0.8222	0.9217	0.9552	(86)
Tweekday	18.4034	18.6927	19.1013	19.5373	19.8496	19.9948	20.0294	20.0256	19.9489	19.5717	18.9132	18.3121	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekend	20.1928	20.3251	20.5140	20.7221	20.8815	20.9656	20.9908	20.9871	20.9343	20.7334	20.4229	20.1513	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7542	19.9560	20.2499	20.5661	20.8171	20.9471	20.9858	20.9801	20.8974	20.5885	20.0989	19.6901	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house	0.9394	0.9108	0.8597	0.7658	0.6229	0.4465	0.3023	0.3364	0.5472	0.7863	0.9065	0.9474	(89)
Tweekday	18.4034	18.6927	19.1013	19.5373	19.8496	19.9948	20.0294	20.0256	19.9489	19.5717	18.9132	18.3121	
Tweekend	18.4034	18.6927	19.1013	19.5373	19.8496	19.9948	20.0294	20.0256	19.9489	19.5717	18.9132	18.3121	
MIT 2	18.4034	18.6927	19.1013	19.5373	19.8496	19.9948	20.0294	20.0256	19.9489	19.5717	18.9132	18.3121	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.7428	19.0101	19.3899	19.7958	20.0927	20.2341	20.2697	20.2654	20.1873	19.8272	19.2111	18.6584	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7428	19.0101	19.3899	19.7958	20.0927	20.2341	20.2697	20.2654	20.1873	19.8272	19.2111	18.6584	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9243	0.8945	0.8443	0.7569	0.6260	0.4609	0.3220	0.3565	0.5584	0.7776	0.8907	0.9330	(94)
Useful gains	620.3382	671.7762	690.3939	662.8844	568.6703	409.2150	273.9004	287.1129	427.0762	547.8168	582.8846	597.6045	(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	1091.3891	1066.2458	974.0421	823.3541	634.2040	425.7452	277.3036	292.0950	459.9907	697.2645	915.1933	1092.5651	(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	350.4618	265.0836	211.0343	115.5382	48.7570	0.0000	0.0000	0.0000	0.0000	111.1890	239.2622	368.2507	(98)
Space heating												1709.5769	(98)
Space heating per m2											(98) / (4) =	23.8901	(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 %)	221.7777	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	770.8514	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	350.4618	265.0836	211.0343	115.5382	48.7570	0.0000	0.0000	0.0000	0.0000	111.1890	239.2622	368.2507	(98)
Space heating efficiency (main heating system 1)	221.7777	221.7777	221.7777	221.7777	221.7777	0.0000	0.0000	0.0000	0.0000	221.7777	221.7777	221.7777	(210)
Space heating fuel (main heating system)	158.0239	119.5267	95.1558	52.0964	21.9846	0.0000	0.0000	0.0000	0.0000	50.1353	107.8838	166.0449	(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	128.5852	98.8808	83.6477	49.4227	26.1676	16.8836	16.3303	36.1229	57.7002	91.8847	114.6604	128.6241	(64)
Efficiency of water heater												170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	75.5140	58.0695	49.1236	29.0243	15.3674	9.9152	9.5903	21.2138	33.8855	53.9610	67.3364	75.5368	(219)
Water heating fuel used												498.5378	(219)
Annual totals kWh/year													
Space heating fuel - main system												770.8514	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)

mechanical ventilation fans (SFP = 0.2294)	49.2222	(230a)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	99.2222	(231)
Electricity for lighting (calculated in Appendix L)	327.6189	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =	-1727.2394	-1727.2394	(233)
Total delivered energy for all uses		-31.0091	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	770.8514	13.1900	101.6753	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	498.5378	13.1900	65.7571	(247)
Mechanical ventilation fans	49.2222	13.1900	6.4924	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	327.6189	13.1900	43.2129	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)

Total energy cost		-4.0901	(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] =	-0.0147	(257)
SAP value		100.2056	
SAP rating (Section 12)		100	(258)
SAP band		A	

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	770.8514	0.5190	400.0719	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	498.5378	0.5190	258.7411	(264)
Space and water heating			658.8130	(265)
Pumps and fans	99.2222	0.5190	51.4963	(267)
Energy for lighting	327.6189	0.5190	170.0342	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			-16.0937	(272)
CO2 emissions per m2			-0.2200	(273)
EI value			100.1850	
EI rating			100	(274)
EI band			A	

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	36.4000 (1b)	x	2.3100 (2b)	=	84.0840	(1b) - (3b)
First floor	35.1600 (1c)	x	2.6100 (2c)	=	91.7676	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 71.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.8516	(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		4.0100	
Infiltration rate		0.2005	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1855	(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	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762	(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	
Solid Door			1.9800	1.0000	1.9800			(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076			(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000	(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360	(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500	(30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500	(30)
Total net area of external elements Aum(A, m2)			157.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000	(32)
Timber GF			55.3000			9.0000	497.7000	(32c)
Timber FF			93.9900			9.0000	845.9100	(32c)
Internal Floor			35.1600			12.6000	443.0160	(32d)
Internal Ceiling			35.1600			9.0000	316.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10525.6020	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.0878	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3394	(36)
Total fabric heat loss	(33) + (36) = 46.5507	(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	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	29.0155	(38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	(39)
Average = Sum(39)m / 12 =												75.5662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	1.0560	(40)
HLP (average)												1.0560	(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	2.2834	(42)
Average daily hot water use (litres/day)	88.4306	(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total = Sum(45)m =		1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.6309	170.7639	178.1726	154.5345	145.4924	129.1582	123.4370	137.2142	143.5085	165.8352	176.4310	189.0791	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq.(G10)
Total of WWHRS savings												-417.7106	
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1140.0998	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1915.3676	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.9672	(H8)
Utilisation factor												0.3985	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												88.4306	(H14)
Volume ratio Veff/V												0.8481	(H15)
Solar storage volume factor												0.9671	(H16)
Solar input												-649.0359	(H17)
Solar input	-19.9770	-30.0254	-50.5666	-69.8985	-84.1813	-88.5971	-86.4697	-77.2180	-60.2689	-40.9998	-24.2826	-16.5511	(63)
								Solar input (sum of months) = Sum(63)m =				-649.0359	(63)
Output from w/h													
	127.1854	99.8553	85.8777	50.2819	29.4016	14.2296	14.6679	33.0015	55.4638	90.5143	112.4130	127.6189	(64)
								Total per year (kWh/year) = Sum(64)m =				840.5110	(64)
Heat gains from water heating, kWh/month													
	87.4659	77.6288	81.6735	70.5644	65.4785	59.3905	58.0364	63.0523	67.5297	77.5714	81.0023	85.9525	(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	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)													
	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)													
	117.5617	115.5190	109.7762	98.0062	88.0088	82.4868	78.0059	84.7477	93.7913	104.2626	112.5032	115.5275	(72)
Total internal gains													
	560.4573	556.3407	535.0642	498.4626	460.9895	432.7098	416.2869	425.1025	449.6799	484.9828	520.6991	546.4812	(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	
Northeast	3.9400	12.9236	0.4600	0.0000	0.7700	18.0354	(75)
Southwest	4.1400	40.4699	0.4600	0.0000	0.7700	59.3446	(79)
Northwest	0.6600	12.9236	0.4600	0.0000	0.7700	3.0212	(81)
Southwest	3.1500	40.4699	0.4300	0.0000	0.7700	42.2087	(79)

Solar gains	122.6099	194.3856	279.9164	387.3747	449.2976	489.7632	461.9781	412.4864	339.1231	234.3692	151.7827	103.0884	(83)
Total gains	683.0672	750.7263	814.9806	885.8373	910.2871	922.4729	878.2650	837.5889	788.8030	719.3519	672.4818	649.5696	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9382	0.9146	0.8621	0.7598	0.6032	0.3995	0.2650	0.2863	0.5233	0.7767	0.9014	0.9459	(86)
Tweekday	18.5888	18.8230	19.2440	19.6664	19.9338	20.0255	20.0360	20.0357	19.9993	19.7129	19.1116	18.5148	

Tweekend	20.2765	20.3843	20.5804	20.7862	20.9285	20.9880	20.9980	20.9974	20.9671	20.8043	20.5145	20.2424	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8834	20.0476	20.3524	20.6661	20.8896	20.9816	20.9970	20.9960	20.9486	20.6980	20.2419	19.8308	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house	0.9273	0.9001	0.8389	0.7217	0.5454	0.3265	0.1835	0.2013	0.4470	0.7322	0.8820	0.9362	(89)
Tweekday	18.5888	18.8230	19.2440	19.6664	19.9338	20.0255	20.0360	20.0357	19.9993	19.7129	19.1116	18.5148	
Tweekend	18.5888	18.8230	19.2440	19.6664	19.9338	20.0255	20.0360	20.0357	19.9993	19.7129	19.1116	18.5148	
MIT 2	18.5888	18.8230	19.2440	19.6664	19.9338	20.0255	20.0360	20.0357	19.9993	19.7129	19.1116	18.5148	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.9140	19.1307	19.5225	19.9176	20.1739	20.2657	20.2775	20.2769	20.2378	19.9604	19.3956	18.8454	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9140	19.1307	19.5225	19.9176	20.1739	20.2657	20.2775	20.2769	20.2378	19.9604	19.3956	18.8454	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9116	0.8838	0.8249	0.7166	0.5540	0.3441	0.2040	0.2227	0.4635	0.7283	0.8666	0.9210	(94)
Useful gains	622.6679	663.5012	672.2431	634.7508	504.2863	317.4392	179.1694	186.4919	365.6374	523.9322	582.7750	598.2452	(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	1043.8745	1022.4652	916.0525	756.9929	542.1064	322.3444	179.6575	187.1733	380.6890	631.7672	861.1246	1038.6916	(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	313.3777	241.2238	181.3942	88.0144	28.1382	0.0000	0.0000	0.0000	0.0000	80.2292	200.4117	327.6921	(98)
Space heating												1460.4813	(98)
Space heating per m2											(98) / (4) =	20.4092	(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 %)	221.7777	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	658.5338	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	313.3777	241.2238	181.3942	88.0144	28.1382	0.0000	0.0000	0.0000	0.0000	80.2292	200.4117	327.6921	(98)
Space heating efficiency (main heating system 1)	221.7777	221.7777	221.7777	221.7777	221.7777	0.0000	0.0000	0.0000	0.0000	221.7777	221.7777	221.7777	(210)
Space heating fuel (main heating system)	141.3026	108.7683	81.7910	39.6858	12.6876	0.0000	0.0000	0.0000	0.0000	36.1755	90.3660	147.7570	(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	127.1854	99.8553	85.8777	50.2819	29.4016	14.2296	14.6679	33.0015	55.4638	90.5143	112.4130	127.6189	(64)
Efficiency of water heater												170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	74.6919	58.6419	50.4332	29.5290	17.2666	8.3566	8.6140	19.3807	32.5721	53.1561	66.0166	74.9465	(219)
Water heating fuel used												493.6052	(219)

Annual totals kWh/year

Space heating fuel - main system	658.5338	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)

mechanical ventilation fans (SFP = 0.2294)	49.2222	(230a)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	99.2222	(231)
Electricity for lighting (calculated in Appendix L)	327.6189	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =	-1824.1596	-1824.1596	(233)
Total delivered energy for all uses		-245.1796	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	658.5338	16.9600	111.6873	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	493.6052	16.9600	83.7154	(247)
Mechanical ventilation fans	49.2222	16.9600	8.3481	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	327.6189	16.9600	55.5642	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)

Total energy cost -41.5825 (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	658.5338	0.5190	341.7790	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	493.6052	0.5190	256.1811	(264)
Space and water heating			597.9601	(265)
Pumps and fans	99.2222	0.5190	51.4963	(267)
Energy for lighting	327.6189	0.5190	170.0342	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			-127.2482	(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	658.5338	3.0700	2021.6986	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	493.6052	3.0700	1515.3680	(264)
Space and water heating			3537.0666	(265)
Pumps and fans	99.2222	3.0700	304.6121	(267)
Energy for lighting	327.6189	3.0700	1005.7900	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	3.0700	-5600.1701	(269)
Primary energy kWh/year			-752.7014	(272)
Primary energy kWh/m2/year			-10.5185	(273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	147.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	232.12	(P1)
Transmission heat loss coefficient	46.55	(37)
Summer heat loss coefficient	278.67	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9400	98.8453	0.4600	0.0000	0.9000	161.2325
South West	4.1400	119.9223	0.4600	0.0000	0.9000	205.5421
North West	0.6600	98.8453	0.4600	0.0000	0.9000	27.0085
South West	3.1500	119.9223	0.4300	0.0000	0.9000	146.1913
total:						539.9744

	Jun	Jul	Aug	
Solar gains	572	540	482	(P3/P4)
Internal gains	447	430	438	
Total summer gains	1019	970	920	(P5)
Summer gain/loss ratio	3.66	3.48	3.30	(P6)

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

Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 147.1)	0.97	0.97	0.97	
Threshold temperature	20.63	22.35	22.07	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			