Energy Calculations Ltd

SAP ◆ CODE ◆ SBEM ◆ DESIGN

01754-761035

SAP Report Submission for Building Regulations Compliance

Client: Carlford Properties Limited

Project: Flat 2:01, 9-10 George Street
Richmond, London, TW9 1JY

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 30/11/2020

EXCELLENCE IN ENERGY ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

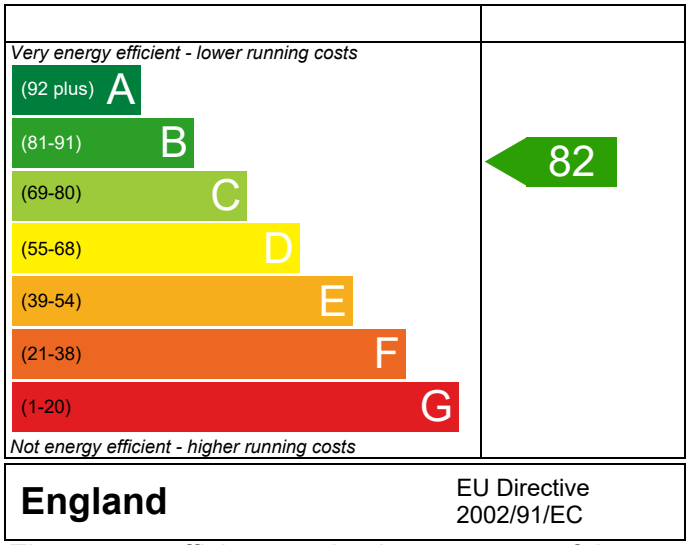
Flat 2:01, 9-10 George Street,
Richmond,
London,
TW9 1JY

Dwelling type:	Flat, Mid-Terrace
Date of assessment:	30/11/2020
Produced by:	Energy Calculations Limited
Total floor area:	53.8 m²
DRRN:	0022-0969-7902

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

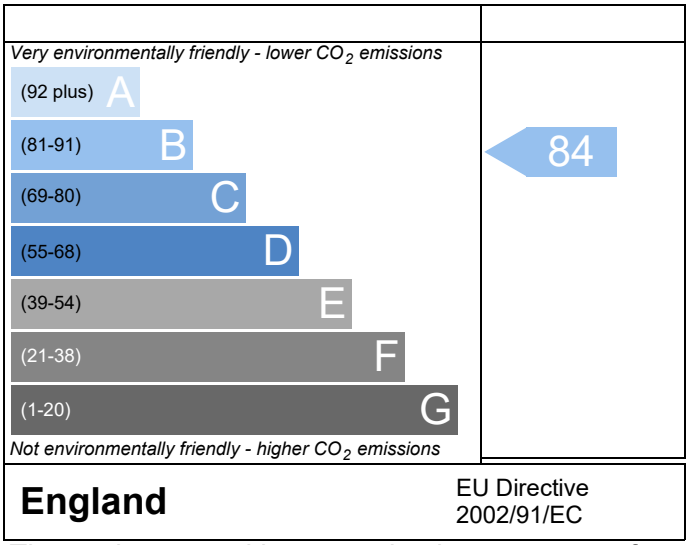
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

THERMAL BRIDGING
Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016859	**Issued on Date**	30/11/2020
Assessment Reference	002 - Clean	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	82 B	**DER**	24.40	**TER**	26.10
Environmental	84 B	**% DER<TER**	6.52		
CO_2 Emissions (t/year)	1.07	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	**Assessor ID**	7869-0001
Client	Carlford Properties		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	9.83	0.55	
External wall	E3 Sill	Table K1 - Approved	0.040	1.80	0.07	
External wall	E4 Jamb	Table K1 - Approved	0.050	16.86	0.84	
External wall	E7 Party floor between dwellings (in blocks of flats)	Independently assessed	0.000	22.25	0.00	
External wall	E14 Flat roof	Table K1 - Default	0.080	4.84	0.39	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	2.55	0.23	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	5.10	-0.46	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.20	0.61	

Total: **2.24** **W/mK:**

Y-Value: **0.039** **W/m²K:**

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

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016859	**Issued on Date**	30/11/2020
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 54 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) 26.10 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 24.40 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)42.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	0.88 (max. 2.00)	1.40 (max. 3.30)	OK

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

3 Air permeability
Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.07 kWh/day
Permitted by DBSCG 1.41 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

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

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.63
Maximum 1.5 OK
MVHR efficiency: 90%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 5.97 m², No overhang
Windows facing East: 14.11 m², No overhang
Windows facing West: 3.00 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Window U-value 0.84 W/m²K
Thermal bridging y-value 0.039 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3151	0.3113	0.3074	0.2880	0.2841	0.2648	0.2648	0.2609	0.2725	0.2841	0.2919	0.2996	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	14.2666	14.0911	13.9157	13.0385	12.8631	11.9859	11.9859	11.8105	12.3368	12.8631	13.2140	13.5648	(38)
Heat transfer coeff	43.5333	43.3579	43.1824	42.3053	42.1298	41.2527	41.2527	41.0773	41.6036	42.1298	42.4807	42.8316	(39)
Average = Sum(39)m / 12 =												42.2614	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8092	0.8059	0.8026	0.7863	0.7831	0.7668	0.7668	0.7635	0.7733	0.7831	0.7896	0.7961	(40)
HLP (average)												0.7855	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0045	12.4387	10.1158	7.6583	5.7247	4.8330	5.2222	6.7881	9.1109	11.5684	13.5021	14.3937	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	298.6596	296.9452	286.8209	270.5970	254.3644	238.5073	228.0637	232.9986	241.2054	257.6052	276.4464	290.3464	(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	
North	5.9700	10.6334	0.6300	0.7000	0.7700	19.4007	(74)
East	14.1100	19.6403	0.6300	0.7000	0.7700	84.6927	(76)
West	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(80)

Solar gains	122.1004	237.9782	393.8584	583.7316	727.6857	751.3026	712.5836	603.1592	460.5485	282.5215	151.9877	100.6286	(83)
Total gains	420.7600	534.9233	680.6793	854.3286	982.0501	989.8099	940.6473	836.1578	701.7539	540.1267	428.4342	390.9751	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.9662	77.2776	77.5915	79.2003	79.5301	81.2212	81.2212	81.5680	80.5362	79.5301	78.8732	78.2271	
alpha	6.1311	6.1518	6.1728	6.2800	6.3020	6.4147	6.4147	6.4379	6.3691	6.3020	6.2582	6.2151	
util living area													
	0.9850	0.9466	0.8222	0.5893	0.3982	0.2667	0.1930	0.2260	0.4083	0.7589	0.9592	0.9896	(86)
MIT	20.3628	20.6089	20.8643	20.9827	20.9985	20.9999	21.0000	21.0000	20.9988	20.9421	20.6325	20.3200	(87)
Th 2	20.2454	20.2482	20.2510	20.2652	20.2680	20.2822	20.2822	20.2851	20.2765	20.2680	20.2624	20.2567	(88)
util rest of house													
	0.9812	0.9352	0.7956	0.5560	0.3671	0.2368	0.1615	0.1909	0.3658	0.7182	0.9484	0.9869	(89)
MIT 2	19.4055	19.7547	20.0948	20.2479	20.2668	20.2822	20.2822	20.2851	20.2757	20.2098	19.8041	19.3528	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.9749	20.2628	20.5525	20.6850	20.7020	20.7091	20.7091	20.7103	20.7058	20.6454	20.2968	19.9281	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9749	20.2628	20.5525	20.6850	20.7020	20.7091	20.7091	20.7103	20.7058	20.6454	20.2968	19.9281	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9796	0.9355	0.8067	0.5752	0.3856	0.2546	0.1802	0.2117	0.3910	0.7397	0.9489	0.9854	(94)
Useful gains	412.1651	500.3982	549.0855	491.3709	378.6735	251.9870	169.5110	177.0484	274.3983	399.5283	406.5519	385.2855	(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													
	682.3803	666.0974	606.8213	498.5661	379.2534	252.0160	169.5133	177.0548	274.8255	423.2096	560.6105	673.6586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	201.0401	111.3498	42.9555	5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496	(98)
Space heating												704.0480	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 13.0864 (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 %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												704.0480	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	201.0401	111.3498	42.9555	5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	201.0401	111.3498	42.9555	5.1805	0.4315	0.0000	0.0000	0.0000	0.0000	17.6188	110.9222	214.5496	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(219)
Water heating fuel used												1445.8455	(219)
Annual totals kWh/year													
Space heating fuel - main system												704.0480	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)													
mechanical ventilation fans (SFP = 0.7875)												131.8053	(230a)
Total electricity for the above, kWh/year												131.8053	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Total delivered energy for all uses												2529.0226	(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	704.0480	0.5190	365.4009	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	0.5190	750.3938	(264)
Space and water heating			1115.7947	(265)
Pumps and fans	131.8053	0.5190	68.4069	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Total CO2, kg/year			1312.5627	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			24.4000	(273)

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

DER		24.4000	ZC1
Total Floor Area	TFA	53.8000	
Assumed number of occupants	N	1.8021	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3024	ZC2
CO2 emissions from cooking, equation (L16)		3.0158	ZC3
Total CO2 emissions		44.7182	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		44.7182	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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3958	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(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	0.3911	0.3834	0.3757	0.3374	0.3297	0.2914	0.2914	0.2837	0.3067	0.3297	0.3451	0.3604	(22b)
Effective ac	0.5765	0.5735	0.5706	0.5569	0.5544	0.5425	0.5425	0.5403	0.5470	0.5544	0.5595	0.5649	(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			1.8600	1.0000	1.8600			(26)
TER Opening Type (Uw = 1.40)			11.6000	1.3258	15.3788			(27)
New Wall	34.5500	11.6000	22.9500	0.1800	4.1310			(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1800	3.6594			(29a)
External Roof 1	1.0000		1.0000	0.1300	0.1300			(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.1592			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7517	(36)
Total fabric heat loss					(33) + (36) =		28.9109	(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	26.0985	25.9641	25.8323	25.2133	25.0975	24.5584	24.5584	24.4586	24.7661	25.0975	25.3318	25.5767	(38)
Heat transfer coeff	55.0094	54.8749	54.7432	54.1242	54.0084	53.4693	53.4693	53.3695	53.6770	54.0084	54.2427	54.4876	(39)
Average = Sum(39)m / 12 =												54.1237	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0225	1.0200	1.0175	1.0060	1.0039	0.9939	0.9939	0.9920	0.9977	1.0039	1.0082	1.0128	(40)
HLP (average)												1.0060	(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		1.8021 (42)
Average daily hot water use (litres/day)		77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)
Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0406	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5619	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
17.4196 15.7338 17.4196 16.8577 17.4196 16.8577 17.4196 17.4196 16.8577 17.4196 16.8577 17.4196 (56)
If cylinder contains dedicated solar storage
17.4196 15.7338 17.4196 16.8577 17.4196 16.8577 17.4196 17.4196 16.8577 17.4196 16.8577 17.4196 (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
166.2902 146.6028 154.0454 138.2026 135.5146 121.2030 116.5126 127.6987 127.4256 143.3027 151.3882 162.3269 (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
166.2902 146.6028 154.0454 138.2026 135.5146 121.2030 116.5126 127.6987 127.4256 143.3027 151.3882 162.3269 (64)
Total per year (kWh/year) = Sum(64)m = 1690.5133 (64)
Heat gains from water heating, kWh/month
74.3103 65.9237 70.2389 64.3577 64.0774 58.7053 57.7593 61.4787 60.7743 66.6670 68.7419 72.9925 (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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
14.0208 12.4531 10.1276 7.6672 5.7313 4.8386 5.2283 6.7960 9.1215 11.5819 13.5178 14.4105 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
157.0879 158.7180 154.6102 145.8653 134.8264 124.4514 117.5203 115.8902 119.9980 128.7429 139.7818 150.1568 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 32.0106 (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)
-72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 -72.0848 (71)
Water heating gains (Table 5)
99.8795 98.1008 94.4072 89.3857 86.1256 81.5352 77.6334 82.6326 84.4088 89.6062 95.4749 98.1082 (72)
Total internal gains
324.0200 322.3037 312.1768 295.9500 279.7151 263.8570 253.4138 258.3506 266.5601 282.9627 301.8062 315.7073 (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	
North	3.0000	10.6334	0.6300	0.7000	0.7700	9.7491	(74)
East	7.0900	19.6403	0.6300	0.7000	0.7700	42.5564	(76)
West	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635	(80)

Solar gains 61.3691 119.6106 197.9577 293.3891 365.7407 377.6101 358.1499 303.1532 231.4766 141.9986 76.3908 50.5771 (83)
Total gains 385.3890 441.9143 510.1344 589.3392 645.4558 641.4671 611.5638 561.5038 498.0367 424.9613 378.1970 366.2843 (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	67.9177	68.0841	68.2480	69.0285	69.1765	69.8739	69.8739	70.0046	69.6036	69.1765	68.8777	68.5681	
alpha	5.5278	5.5389	5.5499	5.6019	5.6118	5.6583	5.6583	5.6670	5.6402	5.6118	5.5918	5.5712	
util living area	0.9952	0.9891	0.9675	0.8895	0.7260	0.5262	0.3836	0.4349	0.7020	0.9396	0.9894	0.9963	(86)
MIT	20.0437	20.2019	20.4629	20.7657	20.9396	20.9917	20.9988	20.9977	20.9627	20.7087	20.3194	20.0145	(87)
Th 2	20.0646	20.0667	20.0687	20.0783	20.0801	20.0885	20.0885	20.0900	20.0852	20.0801	20.0765	20.0727	(88)
util rest of house	0.9937	0.9857	0.9574	0.8594	0.6696	0.4545	0.3047	0.3501	0.6246	0.9156	0.9854	0.9952	(89)
MIT 2	18.7971	19.0279	19.4023	19.8196	20.0265	20.0834	20.0880	20.0891	20.0585	19.7573	19.2072	18.7606	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.5386	19.7262	20.0332	20.3824	20.5696	20.6236	20.6298	20.6295	20.5963	20.3232	19.8688	19.5064	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5386	19.7262	20.0332	20.3824	20.5696	20.6236	20.6298	20.6295	20.5963	20.3232	19.8688	19.5064	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9842	0.9570	0.8701	0.7005	0.4970	0.3517	0.4006	0.6691	0.9228	0.9843	0.9942	(94)
Useful gains	382.5335	434.9157	488.1990	512.7892	452.1116	318.7952	215.0877	224.9550	333.2510	392.1486	372.2613	364.1771	(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	838.2635	813.5853	740.8486	621.4733	479.0333	322.0802	215.4694	225.7285	348.7024	525.1354	692.6121	834.0099	(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	339.0631	254.4660	187.9713	78.2525	20.0297	0.0000	0.0000	0.0000	0.0000	98.9422	230.6526	349.5555	(98)
Space heating												1558.9329	(98)
Space heating per m2											(98) / (4) =	28.9764	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1667.3079	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	339.0631	254.4660	187.9713	78.2525	20.0297	0.0000	0.0000	0.0000	0.0000	98.9422	230.6526	349.5555	(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)													
	362.6343	272.1562	201.0388	83.6925	21.4222	0.0000	0.0000	0.0000	0.0000	105.8206	246.6872	373.8562	(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													
	166.2902	146.6028	154.0454	138.2026	135.5146	121.2030	116.5126	127.6987	127.4256	143.3027	151.3882	162.3269	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6757	86.2716	85.3458	83.3632	81.0337	79.8000	79.8000	79.8000	79.8000	83.8491	85.9341	86.8088	(217)
Fuel for water heating, kWh/month													
	191.8533	169.9316	180.4956	165.7837	167.2323	151.8834	146.0057	160.0234	159.6812	170.9055	176.1678	186.9935	(219)
Water heating fuel used												2026.9572	(219)
Annual totals kWh/year													
Space heating fuel - main system												1667.3079	(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)												247.6113	(232)
Total delivered energy for all uses												4016.8765	(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	1667.3079	0.2160	360.1385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2026.9572	0.2160	437.8228	(264)
Space and water heating			797.9613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	247.6113	0.5190	128.5103	(268)
Total CO2, kg/m2/year			965.3965	(272)
Emissions per m2 for space and water heating			14.8320	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.3887	(272b)
Emissions per m2 for pumps and fans			0.7235	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8320 * 1.55) + 2.3887 + 0.7235, rounded to 2 d.p.			26.1000	(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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.3458	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2680	(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	0.3417	0.3350	0.3283	0.2948	0.2881	0.2546	0.2546	0.2479	0.2680	0.2881	0.3015	0.3149	(22b)
Effective ac	0.5584	0.5561	0.5539	0.5434	0.5415	0.5324	0.5324	0.5307	0.5359	0.5415	0.5454	0.5496	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			20.0000	1036.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11544.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.5749	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.2352	(36)
Total fabric heat loss					(33) + (36) =		29.2667	(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	25.2790	25.1764	25.0758	24.6033	24.5150	24.1035	24.1035	24.0273	24.2620	24.5150	24.6938	24.8807	(38)
Heat transfer coeff	54.5457	54.4431	54.3425	53.8701	53.7817	53.3702	53.3702	53.2940	53.5287	53.7817	53.9605	54.1475	(39)
Average = Sum(39)m / 12 =												53.8697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0139	1.0120	1.0101	1.0013	0.9997	0.9920	0.9920	0.9906	0.9950	0.9997	1.0030	1.0065	(40)
HLP (average)												1.0013	(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		1.8021 (42)
Average daily hot water use (litres/day)		77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)
Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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

26.6918	23.3448	24.0897	21.0020	20.1519	17.3896	16.1140	18.4910	18.7119	21.8069	23.8039	25.8495	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

14.0045	12.4387	10.1158	7.6583	5.7247	4.8330	5.2222	6.7881	9.1109	11.5684	13.5021	14.3937	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)

-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)

Water heating gains (Table 5)

35.8760	34.7393	32.3787	29.1694	27.0859	24.1522	21.6586	24.8536	25.9887	29.3104	33.0610	34.7440	(72)

Total internal gains

257.0002	255.9277	247.1365	232.7249	217.6688	203.4684	194.4329	197.5637	205.1294	219.6535	236.3767	249.3263	(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	
North	5.9700	10.6334	0.6300	0.7000	0.7700	19.4007	(74)
East	14.1100	19.6403	0.6300	0.7000	0.7700	84.6927	(76)
West	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(80)

Solar gains	122.1004	237.9782	393.8584	583.7316	727.6857	751.3026	712.5836	603.1592	460.5485	282.5215	151.9877	100.6286	(83)
Total gains	379.1006	493.9059	640.9949	816.4565	945.3545	954.7710	907.0165	800.7228	665.6779	502.1750	388.3644	349.9549	(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	58.7893	58.9001	59.0091	59.5266	59.6244	60.0841	60.0841	60.1700	59.9062	59.6244	59.4268	59.2217	
alpha	4.9193	4.9267	4.9339	4.9684	4.9750	5.0056	5.0056	5.0113	4.9937	4.9750	4.9618	4.9481	
util living area	0.9921	0.9732	0.9046	0.7272	0.5183	0.3564	0.2587	0.3056	0.5414	0.8741	0.9812	0.9945	(86)
MIT	19.9185	20.1991	20.5788	20.8822	20.9794	20.9974	20.9996	20.9991	20.9818	20.7558	20.2521	19.8624	(87)
Th 2	20.0718	20.0734	20.0749	20.0822	20.0836	20.0900	20.0900	20.0912	20.0875	20.0836	20.0808	20.0780	(88)
util rest of house	0.9900	0.9665	0.8841	0.6868	0.4706	0.3063	0.2053	0.2455	0.4749	0.8390	0.9754	0.9930	(89)
MIT 2	19.0910	19.3679	19.7289	19.9978	20.0714	20.0889	20.0899	20.0909	20.0787	19.9037	19.4289	19.0404	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.5832	19.8623	20.2344	20.5239	20.6115	20.6293	20.6310	20.6311	20.6159	20.4106	19.9185	19.5293	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5832	19.8623	20.2344	20.5239	20.6115	20.6293	20.6310	20.6311	20.6159	20.4106	19.9185	19.5293	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9886	0.9647	0.8880	0.7068	0.4983	0.3361	0.2371	0.2813	0.5139	0.8525	0.9742	0.9919	(94)
Useful gains	374.7757	476.4792	569.1798	577.0455	471.0843	320.8596	215.0118	225.2087	342.0633	428.1168	378.3279	347.1183	(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	833.6319	814.5948	746.3630	626.1781	479.2756	321.7830	215.1340	225.4916	348.7862	527.6281	691.6937	830.0444	(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	341.3890	227.2137	131.8243	35.3755	6.0944	0.0000	0.0000	0.0000	0.0000	74.0364	225.6234	359.2970	(98)
Space heating												1400.8537	(98)
Space heating per m2											(98) / (4) =	26.0382	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	501.6800	394.9396	405.0345	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9921	0.9966	0.9936	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	497.7246	393.5874	402.4618	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1183.7862	1126.6648	1003.4427	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	493.9644	545.4096	447.1298	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1486.5038	(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	123.4911	136.3524	111.7825	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												371.6259	(107)
Space cooling per m2												6.9075	(108)
Energy for space heating												26.0382	(99)
Energy for space cooling												6.9075	(108)
Total												32.9457	(109)
Dwelling Fabric Energy Efficiency (DFEE)												32.9	(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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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							2 * 10 =	20.0000	(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) =	20.0000	/ (5) =	0.1458	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3958	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3067	(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	0.3911	0.3834	0.3757	0.3374	0.3297	0.2914	0.2914	0.2837	0.3067	0.3297	0.3451	0.3604	(22b)
Effective ac	0.5765	0.5735	0.5706	0.5569	0.5544	0.5425	0.5425	0.5403	0.5470	0.5544	0.5595	0.5649	(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			1.8600	1.0000	1.8600			(26)
TER Opening Type (Uw = 1.40)			11.6000	1.3258	15.3788			(27)
New Wall	34.5500	11.6000	22.9500	0.1800	4.1310			(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1800	3.6594			(29a)
External Roof 1	1.0000		1.0000	0.1300	0.1300			(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.1592			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7517	(36)
Total fabric heat loss					(33) + (36) =		28.9109	(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	26.0985	25.9641	25.8323	25.2133	25.0975	24.5584	24.5584	24.4586	24.7661	25.0975	25.3318	25.5767	(38)
Heat transfer coeff	55.0094	54.8749	54.7432	54.1242	54.0084	53.4693	53.4693	53.3695	53.6770	54.0084	54.2427	54.4876	(39)
Average = Sum(39)m / 12 =												54.1237	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0225	1.0200	1.0175	1.0060	1.0039	0.9939	0.9939	0.9920	0.9977	1.0039	1.0082	1.0128	(40)
HLP (average)												1.0060	(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	1.8021	(42)
Average daily hot water use (litres/day)	77.0004	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)
Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.6918	23.3448	24.0897	21.0020	20.1519	17.3896	16.1140	18.4910	18.7119	21.8069	23.8039	25.8495	(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	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	90.1060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0208	12.4531	10.1276	7.6672	5.7313	4.8386	5.2283	6.7960	9.1215	11.5819	13.5178	14.4105	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.0879	158.7180	154.6102	145.8653	134.8264	124.4514	117.5203	115.8902	119.9980	128.7429	139.7818	150.1568	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	32.0106	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	35.8760	34.7393	32.3787	29.1694	27.0859	24.1522	21.6586	24.8536	25.9887	29.3104	33.0610	34.7440	(72)
Total internal gains													
	257.0165	255.9422	247.1483	232.7338	217.6755	203.4741	194.4390	197.5715	205.1400	219.6669	236.3924	249.3430	(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	
North	3.0000	10.6334	0.6300	0.7000	0.7700	9.7491	(74)
East	7.0900	19.6403	0.6300	0.7000	0.7700	42.5564	(76)
West	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635	(80)

Solar gains	61.3691	119.6106	197.9577	293.3891	365.7407	377.6101	358.1499	303.1532	231.4766	141.9986	76.3908	50.5771	(83)
Total gains	318.3856	375.5528	445.1059	526.1229	583.4161	581.0842	552.5889	500.7248	436.6166	361.6655	312.7831	299.9201	(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	67.9177	68.0841	68.2480	69.0285	69.1765	69.8739	69.8739	70.0046	69.6036	69.1765	68.8777	68.5681	
alpha	5.5278	5.5389	5.5499	5.6019	5.6118	5.6583	5.6583	5.6670	5.6402	5.6118	5.5918	5.5712	
util living area													
	0.9981	0.9949	0.9819	0.9245	0.7787	0.5764	0.4238	0.4858	0.7717	0.9682	0.9957	0.9987	(86)
MIT	19.9262	20.0884	20.3619	20.6980	20.9140	20.9870	20.9981	20.9960	20.9400	20.6206	20.2070	19.8973	(87)
Th 2	20.0646	20.0667	20.0687	20.0783	20.0801	20.0885	20.0885	20.0900	20.0852	20.0801	20.0765	20.0727	(88)
util rest of house													
	0.9975	0.9933	0.9758	0.9010	0.7243	0.4997	0.3371	0.3921	0.6962	0.9536	0.9940	0.9982	(89)
MIT 2	19.0824	19.2456	19.5170	19.8436	20.0263	20.0829	20.0880	20.0889	20.0542	19.7804	19.3723	19.0603	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	19.5843	19.7469	20.0195	20.3518	20.5543	20.6207	20.6293	20.6284	20.5811	20.2802	19.8688	19.5582	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5843	19.7469	20.0195	20.3518	20.5543	20.6207	20.6293	20.6284	20.5811	20.2802	19.8688	19.5582	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9926	0.9754	0.9087	0.7535	0.5451	0.3887	0.4480	0.7390	0.9573	0.9935	0.9979	(94)
Useful gains	317.4613	372.7597	434.1601	478.0876	439.5828	316.7397	214.8053	224.3089	322.6776	346.2185	310.7598	299.2861	(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													
	840.7778	814.7230	740.1004	619.8175	478.2054	321.9204	215.4435	225.6702	347.8836	522.8101	692.6135	836.8287	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	389.3475	296.9994	227.6196	102.0455	28.7352	0.0000	0.0000	0.0000	0.0000	131.3842	274.9347	399.9317	(98)
Space heating												1850.9977	(98)
Space heating per m2											(98) / (4) =	34.4052	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	502.6116	395.6730	405.6081	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9626	0.9837	0.9734	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.7993	389.2317	394.8009	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	747.0169	712.4069	652.8061	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	189.5167	240.4423	191.9559	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												621.9149	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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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   47.3792   60.1106   47.9890    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          155.4787 (107)
Space cooling per m2                                                                                                     2.8899 (108)
Energy for space heating                                                                                                34.4052 (99)
Energy for space cooling                                                                                                 2.8899 (108)
Total                                                                                                                   37.2951 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     42.9 (109)


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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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.4000	(22)
Wind factor	0.9250	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8500	(22a)
Adj infilt rate	0.1434	0.1356	0.1356	0.1318	0.1318	0.1201	0.1240	0.1163	0.1124	0.1201	0.1163	0.1318	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2609	0.2531	0.2531	0.2493	0.2493	0.2376	0.2415	0.2338	0.2299	0.2376	0.2338	0.2493	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	11.8105	11.4597	11.4597	11.2842	11.2842	10.7579	10.9334	10.5825	10.4071	10.7579	10.5825	11.2842	(38)
Heat transfer coeff	41.0773	40.7264	40.7264	40.5510	40.5510	40.0247	40.2001	39.8492	39.6738	40.0247	39.8492	40.5510	(39)
Average = Sum(39)m / 12 =												40.3171	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7635	0.7570	0.7570	0.7537	0.7537	0.7440	0.7472	0.7407	0.7374	0.7440	0.7407	0.7537	(40)
HLP (average)												0.7494	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
RHI water heating demand												1446	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	430.6635	427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	
North	5.9700	11.9672	0.6300	0.7000	0.7700	21.8343	(74)
East	14.1100	22.3142	0.6300	0.7000	0.7700	96.2231	(76)
West	3.0000	22.3142	0.6300	0.7000	0.7700	20.4585	(80)

Solar gains	138.5159	234.5422	393.7062	595.1852	724.4903	797.3978	754.9220	653.1849	496.0487	308.4008	172.1866	113.0005	(83)
Total gains	569.1794	661.9454	805.4775	982.7392	1087.4742	1138.0771	1082.3277	987.0713	843.6495	680.3948	571.3593	532.5208	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.5680	82.2708	82.2708	82.6267	82.6267	83.7132	83.3478	84.0817	84.4535	83.7132	84.0817	82.6267	
alpha	6.4379	6.4847	6.4847	6.5084	6.5084	6.5809	6.5565	6.6054	6.6302	6.5809	6.6054	6.5084	
util living area													
	0.9089	0.8259	0.6462	0.4363	0.2796	0.1583	0.0929	0.1130	0.2586	0.5256	0.8063	0.9271	(86)
MIT	20.7543	20.8761	20.9731	20.9977	20.9999	21.0000	21.0000	21.0000	21.0000	20.9946	20.9143	20.7218	(87)
Th 2	20.2851	20.2908	20.2908	20.2936	20.2936	20.3022	20.2993	20.3050	20.3079	20.3022	20.3050	20.2936	(88)
util rest of house													
	0.8919	0.8010	0.6149	0.4075	0.2533	0.1337	0.0668	0.0850	0.2261	0.4861	0.7758	0.9125	(89)
MIT 2	19.9846	20.1468	20.2625	20.2915	20.2935	20.3022	20.2993	20.3050	20.3079	20.2975	20.2107	19.9493	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8959	0.8115	0.6324	0.4245	0.2690	0.1483	0.0823	0.1017	0.2454	0.5094	0.7904	0.9151	(94)
Useful gains	509.9242	537.1821	509.3875	417.2185	292.4796	168.7929	89.0866	100.3560	207.0640	346.5991	451.6143	487.2888	(95)
Ext temp.	5.5000	6.1000	7.9000	10.4000	13.5000	16.5000	18.5000	18.2000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	613.7923	589.7414	520.6928	418.1431	292.5211	168.7934	89.0866	100.3561	207.0781	348.7014	487.3240	604.5654	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	236.2342 (98)
RHI space heating demand	236 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(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	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3151	0.3113	0.3074	0.2880	0.2841	0.2648	0.2648	0.2609	0.2725	0.2841	0.2919	0.2996	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	14.2666	14.0911	13.9157	13.0385	12.8631	11.9859	11.9859	11.8105	12.3368	12.8631	13.2140	13.5648	(38)
Heat transfer coeff	43.5333	43.3579	43.1824	42.3053	42.1298	41.2527	41.2527	41.0773	41.6036	42.1298	42.4807	42.8316	(39)
Average = Sum(39)m / 12 =												42.2614	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8092	0.8059	0.8026	0.7863	0.7831	0.7668	0.7668	0.7635	0.7733	0.7831	0.7896	0.7961	(40)
HLP (average)												0.7855	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	430.6635	427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	
North	5.9700	10.6334	0.6300	0.7000	0.7700	19.4007	(74)
East	14.1100	19.6403	0.6300	0.7000	0.7700	84.6927	(76)
West	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(80)

Solar gains	122.1004	237.9782	393.8584	583.7316	727.6857	751.3026	712.5836	603.1592	460.5485	282.5215	151.9877	100.6286	(83)
Total gains	552.7639	665.3813	805.6298	971.2856	1090.6696	1091.9818	1039.9892	937.0456	808.1493	654.5154	551.1604	520.1489	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.9662	77.2776	77.5915	79.2003	79.5301	81.2212	81.2212	81.5680	80.5362	79.5301	78.8732	78.2271	
alpha	6.1311	6.1518	6.1728	6.2800	6.3020	6.4147	6.4147	6.4379	6.3691	6.3020	6.2582	6.2151	
util living area													
	0.9480	0.8799	0.7335	0.5225	0.3589	0.2418	0.1745	0.2016	0.3549	0.6508	0.8901	0.9592	(86)
MIT	20.5862	20.7704	20.9281	20.9910	20.9992	21.0000	21.0000	21.0000	20.9995	20.9750	20.7955	20.5490	(87)
Th 2	20.2454	20.2482	20.2510	20.2652	20.2680	20.2822	20.2822	20.2851	20.2765	20.2680	20.2624	20.2567	(88)
util rest of house													
	0.9372	0.8602	0.7039	0.4920	0.3308	0.2147	0.1461	0.1703	0.3178	0.6101	0.8683	0.9504	(89)
MIT 2	19.7196	19.9701	20.1711	20.2563	20.2673	20.2822	20.2822	20.2851	20.2762	20.2440	20.0209	19.6778	(90)
Living area fraction										fLA = Living area / (4) =		0.5948	(91)
MIT	20.2350	20.4461	20.6214	20.6933	20.7026	20.7091	20.7091	20.7103	20.7064	20.6788	20.4816	20.1960	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2350	20.4461	20.6214	20.6933	20.7026	20.7091	20.7091	20.7103	20.7064	20.6788	20.4816	20.1960	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9371	0.8657	0.7188	0.5098	0.3475	0.2308	0.1630	0.1889	0.3399	0.6332	0.8752	0.9496	(94)
Useful gains	517.9720	576.0058	579.0590	495.1921	378.9616	252.0014	169.5122	177.0520	274.6609	414.4286	482.3655	493.9573	(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													
	693.7051	674.0454	609.7948	498.9200	379.2798	252.0173	169.5134	177.0551	274.8494	424.6184	568.4602	685.1322	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	130.7454	65.8827	22.8674	2.6841	0.2367	0.0000	0.0000	0.0000	0.0000	7.5812	61.9882	142.2342	(98)
Space heating												434.2199	(98)

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Space heating per m2 (98) / (4) = 8.0710 (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 %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												434.2199	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	130.7454	65.8827	22.8674	2.6841	0.2367	0.0000	0.0000	0.0000	0.0000	7.5812	61.9882	142.2342	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	130.7454	65.8827	22.8674	2.6841	0.2367	0.0000	0.0000	0.0000	0.0000	7.5812	61.9882	142.2342	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(219)
Water heating fuel used												1445.8455	(219)
Annual totals kWh/year													
Space heating fuel - main system												434.2199	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)													
mechanical ventilation fans (SFP = 0.7875)												131.8053	(230a)
Total electricity for the above, kWh/year												131.8053	(231)
Electricity for lighting (calculated in Appendix L)												247.3239	(232)
Total delivered energy for all uses												2259.1945	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	434.2199	13.1900	57.2736	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1445.8455	13.1900	190.7070	(247)
Mechanical ventilation fans	131.8053	13.1900	17.3851	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.3239	13.1900	32.6220	(250)
Additional standing charges			0.0000	(251)
Total energy cost			297.9878	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2667	(257)
SAP value		82.3288	
SAP rating (Section 12)		82	(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	434.2199	0.5190	225.3601	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	0.5190	750.3938	(264)
Space and water heating			975.7539	(265)
Pumps and fans	131.8053	0.5190	68.4069	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Total kg/year			1172.5220	(272)
CO2 emissions per m2			21.7900	(273)
EI value			84.0974	
EI rating			84	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Water heating energy efficiency                                    13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact                                 0.519 / 1.0000 = 0.5190, stars = 2


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

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	53.8000 (1b)	x	2.5500 (2b)	=	137.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.1900	(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		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.5000	3.5000	3.4000	3.4000	3.1000	3.2000	3.0000	2.9000	3.1000	3.0000	3.4000	(22)
Wind factor	0.9250	0.8750	0.8750	0.8500	0.8500	0.7750	0.8000	0.7500	0.7250	0.7750	0.7500	0.8500	(22a)
Adj infilt rate	0.1434	0.1356	0.1356	0.1318	0.1318	0.1201	0.1240	0.1163	0.1124	0.1201	0.1163	0.1318	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2609	0.2531	0.2531	0.2493	0.2493	0.2376	0.2415	0.2338	0.2299	0.2376	0.2338	0.2493	(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	
Door to Hall			1.8600	1.4000	2.6040			(26)
Windows (Uw = 0.84)			23.0800	0.8127	18.7570			(27)
New Wall	34.5500	23.0800	11.4700	0.1800	2.0646	9.0000	103.2300	(29a)
Wall to hall	22.1900	1.8600	20.3300	0.1705	3.4660	18.0000	365.9400	(29a)
External Roof 1	1.0000		1.0000	0.1400	0.1400	9.0000	9.0000	(30)
Total net area of external elements Aum(A, m2)			57.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0316			(33)
Party Wall 1			45.5400	0.0000	0.0000	180.0000	8197.2000	(32)
Party Floor 1			52.8000			30.0000	1584.0000	(32d)
Party Ceilings 1			51.8000			30.0000	1554.0000	(32b)
Internal Wall 1			27.6400			9.0000	248.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12062.1300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	224.2032	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.2352	(36)
Total fabric heat loss	(33) + (36) = 29.2667	(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	11.8105	11.4597	11.4597	11.2842	11.2842	10.7579	10.9334	10.5825	10.4071	10.7579	10.5825	11.2842	(38)
Heat transfer coeff	41.0773	40.7264	40.7264	40.5510	40.5510	40.0247	40.2001	39.8492	39.6738	40.0247	39.8492	40.5510	(39)
Average = Sum(39)m / 12 =												40.3171	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7635	0.7570	0.7570	0.7537	0.7537	0.7440	0.7472	0.7407	0.7374	0.7440	0.7407	0.7537	(40)
HLP (average)												0.7494	(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	1.8021 (42)
Average daily hot water use (litres/day)	77.0004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.7004	81.6204	78.5404	75.4604	72.3803	69.3003	69.3003	72.3803	75.4604	78.5404	81.6204	84.7004	(44)

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

Energy conte	125.6082	109.8578	113.3634	98.8329	94.8326	81.8333	75.8306	87.0167	88.0559	102.6207	112.0185	121.6449	(45)
Energy content (annual)										Total = Sum(45)m =		1211.5155	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8412	16.4787	17.0045	14.8249	14.2249	12.2750	11.3746	13.0525	13.2084	15.3931	16.8028	18.2467	(46)
Water storage loss:													
Store volume												90.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0700	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6420	(55)
Total storage loss													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(56)
If cylinder contains dedicated solar storage													
	19.9020	17.9760	19.9020	19.2600	19.9020	19.2600	19.9020	19.9020	19.2600	19.9020	19.2600	19.9020	(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)
Total heat required for water heating calculated for each month													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(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													
	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1445.8455	(64)
Heat gains from water heating, kWh/month													
	57.6863	50.9085	53.6149	48.2700	47.4534	42.6176	41.1353	44.8546	44.6866	50.0430	52.6542	56.3685	(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	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	108.1272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0113	31.0967	25.2895	19.1458	14.3117	12.0825	13.0556	16.9702	22.7773	28.9211	33.7552	35.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.4595	236.8925	230.7615	217.7094	201.2335	185.7484	175.4034	172.9705	179.1014	192.1536	208.6295	224.1146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	47.6148	(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)													
	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	-72.0848	(71)
Water heating gains (Table 5)													
	77.5354	75.7567	72.0631	67.0416	63.7815	59.1911	55.2893	60.2885	62.0647	67.2621	73.1308	75.7641	(72)
Total internal gains													
	430.6635	427.4031	411.7714	387.5541	362.9839	340.6793	327.4056	333.8864	347.6008	371.9940	399.1727	419.5203	(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	
North	5.9700	11.9672	0.6300	0.7000	0.7700	21.8343	(74)
East	14.1100	22.3142	0.6300	0.7000	0.7700	96.2231	(76)
West	3.0000	22.3142	0.6300	0.7000	0.7700	20.4585	(80)

Solar gains	138.5159	234.5422	393.7062	595.1852	724.4903	797.3978	754.9220	653.1849	496.0487	308.4008	172.1866	113.0005	(83)
Total gains	569.1794	661.9454	805.4775	982.7392	1087.4742	1138.0771	1082.3277	987.0713	843.6495	680.3948	571.3593	532.5208	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.5680	82.2708	82.2708	82.6267	82.6267	83.7132	83.3478	84.0817	84.4535	83.7132	84.0817	82.6267	
alpha	6.4379	6.4847	6.4847	6.5084	6.5084	6.5809	6.5565	6.6054	6.6302	6.5809	6.6054	6.5084	
util living area													
	0.9089	0.8259	0.6462	0.4363	0.2796	0.1583	0.0929	0.1130	0.2586	0.5256	0.8063	0.9271	(86)
MIT	20.7543	20.8761	20.9731	20.9977	20.9999	21.0000	21.0000	21.0000	21.0000	20.9946	20.9143	20.7218	(87)
Th 2	20.2851	20.2908	20.2908	20.2936	20.2936	20.3022	20.2993	20.3050	20.3079	20.3022	20.3050	20.2936	(88)
util rest of house													
	0.8919	0.8010	0.6149	0.4075	0.2533	0.1337	0.0668	0.0850	0.2261	0.4861	0.7758	0.9125	(89)
MIT 2	19.9846	20.1468	20.2625	20.2915	20.2935	20.3022	20.2993	20.3050	20.3079	20.2975	20.2107	19.9493	(90)
Living area fraction									fLA = Living area / (4) =			0.5948	(91)
MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4424	20.5806	20.6851	20.7115	20.7137	20.7172	20.7161	20.7184	20.7195	20.7122	20.6292	20.4088	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8959	0.8115	0.6324	0.4245	0.2690	0.1483	0.0823	0.1017	0.2454	0.5094	0.7904	0.9151	(94)
Useful gains	509.9242	537.1821	509.3875	417.2185	292.4796	168.7929	89.0866	100.3560	207.0640	346.5991	451.6143	487.2888	(95)
Ext temp.	5.5000	6.1000	7.9000	10.4000	13.5000	16.5000	18.5000	18.2000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	613.7923	589.7414	520.6928	418.1431	292.5211	168.7934	89.0866	100.3561	207.0781	348.7014	487.3240	604.5654	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(98)
Space heating												236.2342	(98)

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

Space heating per m2 (98) / (4) = 4.3910 (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 %)	100.0000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	236.2342 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	77.2779	35.3198	8.4111	0.6657	0.0309	0.0000	0.0000	0.0000	0.0000	1.5641	25.7109	87.2538	(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	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	145.5102	127.8338	133.2654	118.0929	114.7346	101.0933	95.7326	106.9187	107.3159	122.5227	131.2785	141.5469	(219)
Water heating fuel used												1445.8455	(219)

Annual totals kWh/year	
Space heating fuel - main system	236.2342 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)	
mechanical ventilation fans (SFP = 0.7875)	131.8053 (230a)
Total electricity for the above, kWh/year	131.8053 (231)
Electricity for lighting (calculated in Appendix L)	247.3239 (232)
Total delivered energy for all uses	2061.2089 (238)

10a. Fuel costs - using BEDF prices (467)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	236.2342	18.7000	44.1758	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1445.8455	18.7000	270.3731	(247)
Mechanical ventilation fans	131.8053	18.7000	24.6476	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.3239	18.7000	46.2496	(250)
Additional standing charges			0.0000	(251)
Total energy cost			385.4461	(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	236.2342	0.5190	122.6056	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	0.5190	750.3938	(264)
Space and water heating			872.9994	(265)
Pumps and fans	131.8053	0.5190	68.4069	(267)
Energy for lighting	247.3239	0.5190	128.3611	(268)
Total kg/year			1069.7674	(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	236.2342	3.0700	725.2391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1445.8455	3.0700	4438.7457	(264)
Space and water heating			5163.9848	(265)
Pumps and fans	131.8053	3.0700	404.6422	(267)
Energy for lighting	247.3239	3.0700	759.2842	(268)
Primary energy kWh/year			6327.9113	(272)
Primary energy kWh/m2/year			117.6192	(273)

SAP 2012 EPC IMPROVEMENTS

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

Current energy efficiency rating: B 82
Current environmental impact rating: B 84

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 82
Potential environmental impact rating: B 84

Fuel prices for cost data on this page from database revision number 467 TEST (29 Oct 2020)
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	£385	£385	£0
Space heating	£69	£69	£0
Water heating	£270	£270	£0
Lighting	£46	£46	£0
Total cost of fuels	£385	£385	£0
Total cost of uses	£385	£385	£0
Delivered energy	38 kWh/m²	38 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	20 kg/m²	20 kg/m²	0 kg/m²
Primary energy	118 kWh/m²	118 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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


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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	224.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	271.64	(P1)
Transmission heat loss coefficient	29.27	(37)
Summer heat loss coefficient	300.90	(P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	1.000	0.90	1.000	0.900	(P8)
East	1.000	0.90	1.000	0.900	(P8)
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	5.9700	81.1852	0.6300	0.7000	0.9000	173.1309
East	14.1100	117.5071	0.6300	0.7000	0.9000	592.2630
West	3.0000	117.5071	0.6300	0.7000	0.9000	125.9241
total:						891.3180

	Jun	Jul	Aug	
Solar gains	950	891	773	(P3)
Internal gains	341	327	334	
Total summer gains	1290	1219	1106	(P5)
Summer gain/loss ratio	4.29	4.05	3.68	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 224.2)	0.43	0.43	0.43	
Threshold temperature	20.72	22.38	21.91	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016859	**Issued on Date**	30/11/2020
Assessment Reference	002 - Clean	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	82 B	**DER**	24.40	**TER**	26.10
Environmental	84 B	**% DER<TER**	6.52		
CO_2 Emissions (t/year)	1.07	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	**Assessor ID**	7869-0001
Client	Carlford Properties		

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	26.10	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	24.40	$kgCO_2/m^2$	Pass
	-1.70 (-6.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.89	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	32.95	$kWh/m^2/yr$	
	-10.0 (-23.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	0.88 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Room heaters - Electric Panel, convector or radiant heaters	
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.07 kWh/day Permitted by DBSCG 1.41		Pass
Primary pipework insulated	No primary pipework		

6 Controls

Space heating controls	Programmer and appliance thermostats		Pass
Hot water controls	Cylinderstat		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	0.63		
Maximum	1.5		Pass
MVHR efficiency	90	%	
Minimum	70	%	Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Medium	Pass

Based on:

Overshading	Average
Windows facing North	5.97 m², No overhang
Windows facing East	14.11 m², No overhang
Windows facing West	3.00 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Solid Wall	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Window U-value	0.84	W/m²K
Thermal bridging y-value	0.039	W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ◆ CODE ◆ SBEM ◆ DESIGN

Property Reference	016859	**Issued on Date**	30/11/2020
Assessment Reference	002 - Clean	**Prop Type Ref**	
Property	Flat 2:01, 9-10 George Street, Richmond, London, TW9 1JY		

SAP Rating	82 B	**DER**	24.40	**TER**	26.10
Environmental	84 B	**% DER<TER**	6.52		
CO_2 Emissions (t/year)	1.07	**DFEE**	32.95	**TFEE**	42.89
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.18		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	**Assessor ID**	7869-0001
Client	Carlford Properties		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Mid-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	22.25 m	53.80 m²	2.55 m

7.0 Living Area	32.00	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	224.2	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
New Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	34.55	11.47
Wall to hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.18	18.00	22.19	20.33

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	45.54

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	27.64

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	1.00	1.00

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Timber I-joists, carpeted	20.00	51.80

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	52.80

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door to Hall	SAP table	Door to Corridor							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	0.84

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door to Hall	Door to Corridor	[2] Wall to hall	North							1.86	
Front Windows	Window	[1] New Wall	West	None	0.00					3.00	
Rear Windows	Window	[1] New Wall	East	None	0.00					14.11	
Side Windows	Window	[1] New Wall	North	None	0.00					5.97	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	Yes	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.83	0.056	No
Table K1 - Approved	E3 Sill	1.80	0.040	No
Table K1 - Approved	E4 Jamb	16.86	0.050	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	22.25	0.000	No
Table K1 - Default	E14 Flat roof	4.84	0.080	No
Table K1 - Approved	E16 Corner (normal)	2.55	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	5.10	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	10.20	0.060	No

Y-value	0.039	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database

Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500625
Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.63
Duct Type	Rigid
MVHR Efficiency	90.00
Wet Rooms	1

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	SAP table	
Percentage of Heat	100	%
Main Heating	REA	
SAP Code	691	
Efficiency (SAP Table)	100.0	%
Controls	CRC Programmer and appliance thermostats	
Sap Code	2603	

25.0 Main Heating 2	None	

Community Heating	None	
28.0 Water Heating	HEI Immersion	
Water Heating	Independent	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	

SAP Code	903	
Immersion Heater	Dual	

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder In Heated Space	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	90.00	L
Loss	1.07	kWh/day

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None